PORTLAND HARBOR RI/FS

ROUND 3A

STORMWATER SAMPLING RATIONALE

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1.0 INTRODUCTION

This document presents the rationale for the approach and procedures to implement stormwater sampling activities in early 2007 to collect data for the Remedial Investigation (RI) and Feasibility Study (FS) within the Portland Harbor Superfund Site (Site). This is a companion document to the Round 3A Stormwater Field Sampling Plan (FSP) (Anchor and Integral 2007), which describes the detailed procedures and methods for collection of stormwater data.

Existing stormwater quality data for the Site are sporadic and relatively limited (Integral et al. 2004). Consequently, estimation of stormwater loads to the river based on existing data or literature values would be highly uncertain. Site-specific stormwater sampling is needed to support stormwater chemical loading estimates for input into the fate and transport model and other estimation tools that will be used in the RI and FS.

The RI/FS project is currently conducting Round 3A sampling for various purposes in the river, which will extend well into 2007. This stormwater sampling is a component of the Round 3A sampling. The FSP describes the field sampling, and the Quality Assurance Project Plan (QAPP; Integral 2007) provides the laboratory analysis procedures to accomplish the following types of data collection:

- Stormwater chemistry, total suspended solids (TSS), and associated conventional parameters
- Stormwater sediment chemistry and associated conventional parameters

The rationale for the field study approach for stormwater is described below.

1.1 BACKGROUND AND CONTEXT

In November 2006, the U.S. Environmental Protection Agency (EPA) and Lower Willamette Group (LWG) determined that stormwater data were needed to complete the RI and FS, and that such data would need to be collected in the 2006/2007 wet-weather season to fit within the overall RI/FS project schedule. They convened a Stormwater Technical Team, which included representatives from EPA, Oregon Department of Environmental Quality (DEQ) and the LWG, to develop the framework for a sampling plan. The sampling framework described in the FSP was developed by the Technical Team and is based on an EPA memorandum dated December 13, 2006 (Koch et al. 2006). This framework was discussed and approved by Portland Harbor Managers from EPA, DEQ, the Tribes, and LWG on December 20, 2006.

During the fall and winter of 2006/2007, the Port of Portland was and is simultaneously implementing an evaluation of potential stormwater sources, loading, and recontamination potential at the Portland Harbor Terminal 4 site for an early action removal action under a separate EPA-approved work plan. The overall methodology, scope, and objectives of the Terminal 4 stormwater work is generally consistent with the sampling discussed below (i.e., sediment traps and three composite water sampling events), and the data from this work will be included within the overall RI/FS stormwater investigation. Some details of the Terminal 4 work will be adjusted to be as consistent as possible with the approach described in the FSP. However, because the Terminal 4 work was designed for an additional purpose (i.e., to address source control objectives), there may be minor differences in implementation details including those noted in Table 1-1.

Table 1-1. Summary of Main Differences Between LWG Stormwater FSP and Terminal 4 Stormwater/Sediment Sample Collection Procedures.

Procedure	**LWG**	**Terminal 4**
Flow-weighted stormwater sample collection	Collected into seven 1.8-liter glass bottles	Collected into four 1-gallon glass bottles
Analysis of phthalates in water	Collected at a subset of 11 locations	Collected at all seven locations
Stormwater sample collection for dissolved analyses	Grabs at a subset of 10 locations	Flow-weighted composite at all seven locations
Sediment sample collection	Two bottles per sediment trap	Four bottles per sediment trap

These small differences are not expected to present any obstacles to using this information in the RI/FS.

The sampling framework is designed to complete stormwater data collection by the end of the 2006/2007 wet-weather season (i.e., May/June 2007) to prevent delay of the RI/FS schedule. This necessarily means that data collection can only occur over the latter portion (March through May) of this wet-weather season, rather than sampling of storm events over several years of wet-weather seasons.

Given this timing limitation, the Stormwater Technical Team evaluated a range of stormwater data collection technical approaches and selected the ones described in this document based on (1) the ability to meet the objectives for data use (see Section 1.2) as agreed to by the Portland Harbor managers and (2) practicability in terms of schedule, cost, and feasibility.

When using data generated from the FSP for modeling or other estimation tools, it will be important to keep in mind the above limitations. Both the small number of storm events sampled (three events) and the limited timeframe for collecting samples (March through May of a single water year) will need to be considered when extrapolating from these data to estimate average annual chemical loads to the river over several years duration. The proposed pooling of data to estimate average concentrations will improve overall stormwater estimates to address some of the limitations in data use.

1.2 SAMPLING PURPOSE AND OBJECTIVES

The purpose of this sampling and analysis effort is to provide data for evaluating the potential risk and sediment recontamination from stormwater discharges to the river. These data will be used for understanding the relative magnitude of stormwater impacts to the harbor, developing the draft Site RI, identifying remaining stormwater data gaps, and eventually evaluating remedial alternatives in the Site FS.

The objectives of this stormwater sampling program as discussed by the Stormwater Technical Team are defined as:

1. Understand stormwater contribution to in-river fish tissue chemical burdens.
2. Determine the potential for recontamination of sediment (after cleanup) from stormwater inputs.

The focus of the FSP is to obtain data that meet RI/FS objectives, and the Stormwater Technical Team devised the sampling framework with this intent. The RI/FS objectives and use as they relate to the FSP are discussed in more detail in Sections 1.2.1 and 1.2.2, below. The Stormwater Technical Team also considered techniques and approaches that could feasibly provide potential overlapping data that DEQ can use to meet Source Control Objectives as described in the EPA/DEQ Joint Source Control Strategy (JSCS) (DEQ and EPA 2005). The DEQ Upland Source Control objectives include the following:

1. Evaluate stormwater discharges to identify potentially significant hazardous substances that could reach the river.
2. Identify, prioritize, and control significant stormwater sources as necessary to prevent contamination of Willamette River water and sediments and recontamination of river sediments following the Portland Harbor cleanup.

In addition to the stormwater data collection activities described in the FSP, DEQ is pursuing collection of stormwater data at a number of Portland Harbor sites as a part of the JSCS to meet the above source control objectives. Stormwater data are also being collected by National Pollutant Discharge Elimination System (NPDES) permittees in Portland Harbor. As these data or any other site-specific stormwater data become available, they will be used wherever possible and technically defensible to augment the estimations of stormwater loads based on data collected as described in the FSP to help meet the above RI/FS objectives.

The RI/FS objectives and the use of the stormwater data in the RI/FS process are discussed in more detail below.

1.2.1 RI/FS Stormwater Objectives

1.2.1.1 Stormwater Contribution to Fish Tissue Burdens

Surface water chemicals have the potential to contribute to fish tissue burdens (and related risks) in the harbor. The importance of various sources of surface water chemicals, particularly stormwater, is not well understood. The sources to the water column from resuspension of sediment versus other waterborne sources (such as stormwater) must be known in order to develop sediment and surface water preliminary remediation goals (PRGs) that are intended to minimize fish tissue related risks for the Site.

Thus, it is necessary to determine the relative contribution of stormwater (as compared to other sources) to surface water concentrations of selected chemicals in the harbor. For stormwater, this would be done in terms of loading estimates. To understand the relative contribution of stormwater chemicals to fish tissue burdens other sources of chemicals also need to be understood. Other potential sources to the water column and fish tissue that are currently being investigated by the LWG are contributions from upstream, in-river sediment chemicals, and groundwater.

1.2.1.2 Stormwater Contribution to Recontamination Potential

Stormwater discharges have the potential to contribute to recontamination of sediments near outfalls (and/or potentially harbor-wide for some chemicals) after cleanup has been completed, if the discharges contain chemicals attached to settling solids. The potential for this outcome must be assessed at an FS-appropriate level of detail to understand the general extent and need for source controls, as well as determine the appropriate cleanup remedies.

To predict whether sediments would recontaminate at levels above the PRGs that will eventually be set for the Site, estimates of stormwater loads are needed for input into estimation tools and models described in Section 1.3; these load estimates must be on a spatial scale consistent with those estimation tools and models. The load estimates should be accompanied by partitioning measurements to assist in the estimation of chemical mass associated with particulates (that may settle to the sediment bed) versus dissolved mass.

1.2.2 RI/FS Use of Stormwater Data

Several evaluation modeling tools will use the collected data to meet the above objectives. The modeling tool of primary consideration is EPA's fate and transport model described by Hope (2006). This tool is being used by DEQ to help identify and prioritize the stormwater sources that may require source control measures. It is also being used by EPA/LWG in combination with the LWG-developed in-river hydrodynamic and sedimentation model (West 2005) to directly evaluate the RI/FS objectives above. These models require estimates of the chemical mass load (e.g., kilograms per year) from each type of chemical source (e.g., stormwater, groundwater, upstream, etc.) for each of the model-defined segments of the river.

1.3 SAMPLING RATIONALE AND DATA USE

The FSP describes the procedures and methods for measuring the concentrations of chemicals in stormwater and for obtaining stormwater flow data at 31 locations in the Site to meet the above objectives. These data will be used, in conjunction with estimation and evaluation tools described below, to assess the nature and extent of chemical loading from stormwater discharges to the Site. In summary, the sampling approach described in the FSP involves:

1. Flow-weighted composite water samples from three storm events including whole water for organic compound analyses and filtered/unfiltered pairs for metals analyses.

2. One additional set of grab stormwater samples at 10 of the 31 sampling locations of filtered/unfiltered pairs for analysis of selected organic compounds to obtain partitioning data that can be used to validate model algorithms.

3. Sediment trap deployment and sampling for a minimum duration of 3 months.

4. Continuous flow monitoring at each sampling location for the duration of the sampling effort.

The rationale for this sampling approach to meet RI/FS objectives is described in more detail in the remainder of this document.

1.3.1 Sampling Location Rationale

In general, to estimate stormwater loads, a chemical concentration in stormwater and the volume of stormwater discharge (i.e., time-integrated flows) must be known. These terms can be either directly measured or estimated through indirect means (e.g., runoff modeling of stormwater volumes).

As stated above, the purpose of this sampling effort is to provide data for evaluating the potential risk and sediment recontamination from stormwater discharges to the river. Because the scope of this data collection effort is to provide sufficient data for an FS-level evaluation of stormwater loads and contributions to potential in-river risk and recontamination issues for Site, it is not necessary to have direct measurements from every stormwater discharge to the Site. Direct measurements of stormwater loads would require a large number of samples because of the variability of stormwater quality and quantity.

Thus, the sampling location rationale involves the commonly used approach of applying “representative” estimates of stormwater chemical concentrations for various land use types (Scheuler 1987). A land-use-based chemical load modeling approach will be used to estimate loads across the entire Site. Chemical loading models use site characteristics (e.g., land use and percent impervious area) and land-use-specific loading rates to estimate overall loading into the receiving waters. This approach has been modified to better fit the unique data needs and land use characteristics of the Site, as well as the practical constraints for this sampling effort. Key considerations contributing to the design of the FSP include the following:

- While there are well-substantiated estimates of land use-based chemical loading rates available from both local and national stormwater management studies, these estimates generally do not include data on key chemicals of interest for the Portland Harbor RI/FS.
- Industrial land uses are of particular concern at this Site. When compared to other land uses at the Site (e.g., residential, commercial, and open space), local and other studies have shown industrial land uses typically have higher loading rates of many chemicals (Scheuler 1987, Woodward-Clyde 1993, Pitt et al. 1995, Woodward-Clyde 1997, Parker et al. 2000, Burton and Pitt 2002, Rossi et al. 2004, and Maestre and Pitt 2005) and may generate runoff with unique chemical characteristics depending on the particular industrial activities that have occurred or are currently occurring at that upland site. Additionally, historic operations that have resulted in contamination of upland soils will make each upland site unique in its discharge loading rate. This results in a high degree of variability in stormwater chemical concentrations for this land use. Thus, caution is needed when using "representative" chemical concentrations to extrapolate loading estimates from unmeasured drainage basins. Representative concentrations may be applicable for some industrial sites, but not for others, and will only be used when site-specific information is not available.
- The number of outfalls that need to be extrapolated using representative loading rates can be minimized by directly measuring loads. This can be addressed by giving preference to sampling locations as close to the outfall discharge point as possible, while taking into account any physical limitations, and maintaining the approach of isolating certain land uses within a reasonable subset of the sampling locations. Similarly, where one location at or near a basin's discharge point can be sampled, this would be preferred to extrapolating loads based on land use from many other sampling points outside the basin.

Given these and other considerations, it was decided that sampling will occur at three categories of locations to obtain a practicable and sufficient dataset from subset of drainage basins/outfalls within Site. These sampling locations fall into the following three categories:

1. **Representative Land Use Locations.** Eleven locations were selected as representative of certain types of land use (based on zoning) within the overall drainage area. These land use types are as follows[1]:

   - Residential (one location) representing less than 25 percent of the overall drainage to the Site
   - Major transportation corridors (two locations) representing less than 5 percent of the area
   - Heavy industrial (five locations) with total industrial land use (heavy and light) representing less than 30 percent of the area
   - Light industrial (two locations) with total industrial land use (heavy and light) representing less than 30 percent of the area
   - Open space (one location) representing more than 40 percent of the area.

2. **Specific Industrial Locations.** Eleven industrial locations were selected with unique or unusual potential chemical sources that cannot be easily extrapolated from generalized land use measurements.

3. **Multiple Land Use Locations.** Two locations were selected to directly measure stormwater discharge from relatively large basins that have a mixture of land use zones to provide a cross-check with land use loading estimates.

The specific locations to be sampled within each of these categories are shown in Table 1-2. In addition to the above categories, Table 1-2 includes seven (7) sampling locations associated with the Port of Portland's Terminal 4 recontamination study. As discussed in Section 1.1, the overall sampling approach for the Terminal 4 sampling is the same as described in the FSP, and the data generated will be consistent with those generated at other locations. Data from these locations will be used similar to that described in Section 1.3.2 for "land use-based" locations using the categories identified in Table 1-2. This will add one additional residential land use, two light industrial, and four heavy industrial locations. However, the data from the four heavy industrial type locations may be grouped with the Specific Industrial Location category based on results evaluations, and in such an event, would be used consistent with data from this category of sampling locations as described in Section 1.3.2.

A discussion of how the data from each category will be used for the RI and FS is discussed in the following section.

[1] Note another kind of land use commonly evaluated in stormwater investigations is the "commercial" category, but this is a very minor use (less than 1 percent) within the overall drainage and was judged not to warrant a specific sampling location. Data from the residential land use type will likely be used for commercial land use areas.

1.3.2 Data Use

Chemical concentration data from the first category of locations (representative land use locations) will be pooled by land use type to arrive at chemical concentrations that are representative of each land use category. These values will be used to estimate loading for other basins with the same land use where site-specific data are not available.[2] For example, stormwater chemical concentrations measured from residential land use basins will be applied to other residential land use basins without sufficient data and converted to extrapolated loads based on the estimated volumes of stormwater discharged from each residential basin within the Site. The resulting series of extrapolations will provide total stormwater loads for these land uses across the entire Site drainage that can be input into the fate and transport model and other estimation tools.

Chemical concentration data from the second category of locations (unique industrial sites) may be used in two ways. First, the data will be used to develop loading rates for the specific basin associated with that sampling location. Second, for locations where the unique chemical character of stormwater only applies to a certain type or types of chemicals, the other chemical concentrations measured at this location might be pooled with the land use data as described above. For example, a metals handling facility may have a unique chemical character for metals, but the other chemicals (e.g., polychlorinated biphenyls [PCBs], semivolatile organic compounds [SVOCs], etc.) may be used in the heavy industrial representative land use data set. In general, the data reduction approach for sampling locations at unique industrial sites is expected to entail pooling the data for each parameter (TSS, water chemical concentration, and sediment chemical concentration), removing the high outlier data (i.e., unique chemicals) and combining the remainder with data from the land use locations to generate a heavy industrial value for use in extrapolation to non-sampled heavy industrial areas. Thus, data collected at the "unique" industrial sites should not be viewed as only useful to directly measure concentrations from these particular sites because these data may have wider application to the study.

The third category of locations (basins with multiple land uses) will not be used for extrapolated loading estimates because these locations measure a variety of land uses in one sample. These results will be used as an independent verification of extrapolated loads to calibrate the extrapolated load methods and determine uncertainties in the overall approach.

The stormwater chemical model used to estimate loading is the subject of ongoing discussions between EPA, DEQ, and the LWG. As this effort moves forward, the limitations of the data set generated using the methods described above need to be taken into consideration. For example, the land use estimates are a general representation or "average" estimate of the potential loads from these types of land use. This approach can be inaccurate if substantial unusual conditions lay within any of the extrapolated basins.

[2] Because industrial sites are expected to demonstrate a higher degree of variability in contaminant concentrations than other land uses, the list of sampling sites includes a higher proportion of industrial land use sites in an attempt to better capture this variability.

Also, there are limitations to using such data on a small scale since "averages" do not capture the variability that can occur among individual properties.

1.3.3 Measurement Methods

Ideally, estimation of long-term loads would involve a large number of water samples taken over the course of many years and many types of storms, pollutant sources, and runoff conditions. However, such an approach is not necessary to meet the objectives for the FSP and would cause unacceptable schedule delays for the RI/FS. Therefore, both whole-water chemistry samples and suspended sediment chemistry samples will be collected at the locations listed in Table 1-2. These two measurements will provide data to support two independent means of estimating stormwater chemical loads. For whole water, chemical concentrations (mass chemical/volume water sample), these values are multiplied by the volume of water discharging at the location over a set time to yield a load in mass/time. For suspended sediment, chemical concentrations (mass chemical/mass sediment) are multiplied by TSS concentrations (mass sediment/volume water sample) measured in water samples and the volume of water discharging at the location over a set time to yield a chemical load in mass/time.

It is anticipated that these two methods (whole water and suspended sediment) will result in different predictions of mass loading at most locations. The reason for having two independent methods to estimate loads is that each method has some intrinsic measurement artifacts that will lead to varying load estimates. The advantages and disadvantages of each method are to some extent complementary. By using two approaches, the disadvantages of each method can be better understood and the two loading estimates compared to provide a better overall sense of the potential range of chemical loads. The advantages and disadvantages of both methods are discussed in the remainder of this section.

Stormwater chemical concentrations are known to be widely variable depending on a variety of factors such as:

- The specific chemical sources within the drainage basin, which may vary over time and location within the basin
- The characteristics of the storms and their associated runoff (i.e., antecedent dry periods; storm amounts, intensity, and durations; stormwater collection system characteristics; and presence, condition and proper functioning of source controls)
- How and where stormwater is sampled
- When in the storm the samples are collected (i.e., first flush, rising limb, falling limb, etc.)

The primary advantage of whole-water sampling is that it provides a direct measure of the chemical concentrations in the water that can be converted to a load in one step (multiplication by volume discharged over a unit time). The disadvantages of whole-water sampling are that it captures one relatively small condition in time, it may preferentially capture only the fines portion of the particulate load, and it cannot provide the concentration in the particulate fraction without a very large sample volume.

Additionally, methods that integrate, average, or estimate long-term chemical concentrations and flows over time will be used for the RI and FS to determine long-term risk exposure and recontamination rates. For this reason, water sampling for this project will be conducted using composite sampling techniques, where a large portion of a runoff event is sampled, rather than one or two grab samples within that runoff event.

Another disadvantage of composite whole-water samples is that analytical detection limits may not be adequate to detect chemicals that tend to be present in stormwater at very low concentrations, such as PCBs. This is the main advantage of collecting suspended sediment chemical concentrations and one of the main reasons for including sediment traps in this sampling effort. If sediment traps are left in place long enough, they can accumulate a large enough sediment sample to reduce the likelihood that analytical limitations will be a barrier to meeting data quality objectives.

The other advantages of sediment traps is that they integrate the particulate associated chemical loading over time, they avoid the need for large numbers of water chemistry samples, and they provide data for the stormwater particulate load that may recontaminate river sediment. The disadvantage of sediment traps is that (1) they do not estimate the dissolved load and (2) they may preferentially capture only portions of the coarser fraction of the particulate load. Thus, they provide a much less direct measurement of the overall load that may be present in the stormwater being discharged.

Information on grain sizes in sediment traps could be useful in understanding the potential for particulate associated stormwater pollutants to settle and recontaminate river sediments. However, due to the lack of information on chemicals and the expected sediment sample volume limitations, it was necessary to rank the analytes in priority order, and grain size analysis was given the lowest priority so that it did not jeopardize the analysis of chemicals for the study. Consequently, grain size data will likely be obtained for only a subset of sediment samples collected.

The sampling framework includes certain elements deemed necessary to vet modeling assumptions and calculation methods. One particular data need of this type is collection of filtered and unfiltered stormwater samples to help validate the partitioning algorithms used in the fate and transport model and other estimation tools. Filtered/unfiltered water sample pairs will be collected at all sampling locations and analyzed for metals on the analyte list because site-specific metals partitioning is difficult to predict based on literature information. In addition, limited grab sampling of filtered/unfiltered water will be conducted at a subset of sampling locations and analyzed for organic compounds and associated conventional parameters (e.g., total organic carbon [TOC] and dissolved organic carbon [DOC]) to provide information on the range of partitioning characteristics for these chemicals. The partitioning of organic compounds is generally more predictable based on literature information, but some limited data collection for organic compounds will help validate if these predictions are accurate for this application.

1.3.4 Flow Information

Each of the various methods of estimating loads discussed above require some estimate of the volume of water discharged over unit time, which is defined as flow. Flow information will be collected at each location during the duration of the sampling effort. However, the primary use of this flow information will not be in the calculation of stormwater chemicals loads because:

- The period measured is only a portion of the year and loads will need to be estimated on an annual basis
- There will be insufficient time to calibrate flow measurements at each location to arrive at an accurate measurement of flows over the period measured.

The primary purpose of the flow measurements will be to assist in the composite sampling of stormwater on a flow-weighted basis. In general, the amount of sample taken is proportional to the flow of water present over the time period the sample is intended to represent. Each sample is then combined so that the composite sample is "weighted" based on the flow. Flow-weighted composite methods are described more in the FSP.

Volumes of water for use in extrapolated loading estimates will be estimated by independent methods currently being discussed by the Stormwater Technical Team. In general, average annual volumes of discharge for each sampling location will be estimated using runoff estimation and modeling tools that are commonly applied to stormwater loading and conveyance system design.

1.3.5 Additional Considerations

Some other techniques and conditions were considered in the sampling design but not selected. The reasons for such selections are discussed briefly below.

Sediment traps were selected as the method to measure chemical concentrations on stormwater particulates. Other methods exist to obtain sediment samples, such as pumping and filtering large amounts of stormwater and analyzing the solids captured by the filter (and similar methods of capturing particulates in water). Sediment traps were preferred because they passively capture sediment over a long period of time and wide range of conditions and are logistically simple to implement. By comparison, active filtering or capturing techniques are labor intensive and sample over a relatively short period of time, such as hours or perhaps a few days, and thus, have the same time integration limitations as composite stormwater sampling. However, high volume water filtering techniques will be employed if sediment trap deployment is infeasible (e.g., due to space limitations) and are described as a contingency method within the FSP.

The Stormwater Technical Team determined that TSS should be measured in whole-water samples to support the loading calculations based on sediment trap data as described in Section 1.3.3 above. Various methods exist for measuring particulates in stormwater including Suspended Sediment Concentration (SSC) methods developed by the U.S. Geological Survey (USGS). In general, the SSC method filters the entire sample where the TSS method only filters the aliquot being analyzed. The SSC is reported by the USGS to provide a more accurate determination of the suspended sediment mass in water samples than TSS (Gray et al. 2000). However, TSS method is much more widely used and any historical data sets available for the sampling locations will likely be in the form of TSS. Because this historical information may be valuable in better estimating the range of suspended sediment conditions that might apply to estimates of chemical loads using sediment trap data, it appeared more important to collect any additional suspended sediment data for this program by a consistent means. Consequently, it was determined that the biases introduced by the TSS method are not so great as to warrant the inability to compare historical and new data sets.

The Stormwater Technical Team determined that three composite storm events would be sampled at each location. Greater and lesser numbers of events were considered. Given the time limitations of the study, three events appeared to represent a good balance between the preference for as many stormwater samples as possible to address the variability issues discussed above, the allowable timeframe for the sampling, the number of appropriate storm event criteria that would occur in that timeframe, and costs. Once the data generated through the FSP are available, it will be evaluated along with other RI/FS and source control information to determine whether there are stormwater data gaps that will need to be addressed through additional stormwater data collection in the future.

2.0 RATIONALE FOR SPECIFIC FSP ELEMENTS

The priority order and list of chemicals analyzed will vary somewhat for each sampling type between locations shown in Table 1-1. The rationale for variation in chemical lists for sampling locations and the rationale for other specific methods for each sample type is described below.

2.1 COMPOSITE WATER SAMPLING

Organochlorine pesticides will be analyzed in composite water samples at the following sampling locations given their potential source histories:

- WR-96 – Arkema
- OF-22B – Arkema and Rhone-Poulenc

Only a subset of locations will be analyzed for phthalates because of the logistical difficulties of avoiding phthalate contamination from field sampling equipment and laboratory analysis. Through Stormwater Technical Team discussions, it was determined that it was appropriate to analyze for phthalates at those locations where it was likely for phthalate-related in-river risks that might be linked to potential upland sources. In order to verify the assumptions behind potential phthalate sources, analyses should also be conducted for some locations that were not known or suspected phthalate sources. The preliminary risk evaluations currently underway by the LWG were reviewed for potential phthalate-related risks near any of the proposed stormwater sampling locations. The following list of locations for phthalate analyses containing both potential and unlikely sources of phthalates was determined from the above research:

- WR-24 – Oregon Steel Mills
- WR-121/123 – Schnitzer
- WR-96 – Arkema
- WR-161 – Portland Shipyard
- WR-145 – Gunderson
- WR-147 – Gunderson (former Schnitzer)
- OF-M2 – City basin with Light Industrial Uses
- OF-18 – City basin with Multiple Land Uses (predominantly Heavy Industrial and Open Space)
- St. Johns Bridge – Oregon Department of Transportation (ODOT)
- OF-49 – City basin with Residential Use

- OF-22C – Upstream at Forest Park (Open Space Land Use)

Also, phthalate analyses will take place at all Terminal 4 locations. This will result in a total of 18 locations (listed in the FSP) known at this time that will receive phthalate analyses.

The target storm conditions for sampling are: storms predicted to produce more than 0.2 inches rainfall over a minimum of a 3-hour period, not to exceed approximately 2.25 inches in a 24 hour period (equivalent to the 2-year event), and to have been preceded by at least a 24-hour dry period (less than 0.1 inches rainfall). The objective is to get a composite sample that represents aliquots over the entire storm hydrograph. This is the primary reason for the approximate maximum on the storm criteria.

2.2 STORMWATER GRAB SAMPLES

During one storm event, discrete stormwater "grab" samples will be collected from 10 locations where it is most likely that organics would be detected in water samples. Because the purpose of the grab samples is to collect partitioning rather than loading data, samples will be collected during storm periods expected to have higher chemical concentrations (e.g., first flush or rising limb), to increase the likelihood of detecting these chemicals. All samples will be analyzed for TOC/DOC in addition to chemical parameters. The sampling locations were selected based on general knowledge of site uses and potential chemical sources. The following list of locations, spanning the likely primary chemicals of interest for the harbor, was determined for this sampling:

- WR-24 – Oregon Steel Mills (PCBs[3]/phthalates)
- WR-121/123 – Schnitzer (PCBs/phthalates)
- WR-96 – Arkema (DDx/phthalates)
- WR-107 – Gasco (PAHs)
- WR-145 – Gunderson (PCBs/PAHs/phthalates)
- St. Johns Bridge – ODOT (PAHs/phthalates)
- OF-18 – Industrial/Open Space Land Use (PCBs/PAHs/phthalates)
- OF-22B – Heavy Industrial (pesticides, various)
- WR-161 – Portland Shipyard (phthalates)
- OF-22 – Willbridge (PAHs)

[3] All references to PCBs throughout this document refer to the analyses of PCB congeners (as opposed to PCB Aroclors).

Also, all composite samples for the Terminal 4 locations will include filtered and unfiltered pairs for all chemicals analyzed including organic compounds.

Additionally, organochlorine pesticides will be analyzed at Arkema (WR-96 and OF-22B) and Rhone-Poulenc (OF-22B). Because filtering methods (e.g., filter matrix) differ between organic compounds and metals, metals will not be filtered and analyzed for these grab samples. Storm conditions for grab sampling are the same as for composite sampling described in Section 2.1, with grab samples taken sometime in the rising limb of the hydrograph of a continuous storm meeting the above requirements. One grab sampling event will be conducted for each location and one storm may be suitable for obtaining the event at multiple locations.

2.3 SEDIMENT TRAP SAMPLES

Sediment traps will generally be installed at each sampling location as close to the target junction or outfall as possible and downstream of the automatic sampler intake tube. Sediment traps will be inspected at a minimum on a monthly basis. When inspected, if the collection bottle is more than half full of sediments, the bottle will be collected and archived and an empty collection bottle will be returned to the trap. If the collection bottle is less than one third full at the first monthly inspection, options for repositioning or relocating the equipment or adding additional traps to obtain a better collection rate will be considered. At the end of the deployment period, all sediments for each location will be combined, homogenized, and sampled for analyses in the priority order presented in the FSP.

Analytes are ranked in priority order in the event that any collected sample size is insufficient to run all analyses. Given that some industrial sites are not known or suspected sources of organochlorine pesticides, but are potential sources for PAHs and phthalates, the priority order of these two chemical classes will be reversed for the following locations:

- WR-24 – Oregon Steel Mills
- WR-121/123 – Schnitzer
- WR-109 – Schnitzer Riverside
- WR-107 – Gasco
- WR-14 – Chevron
- WR-161 – Portland Shipyard
- WR-4 – Sulzer Pump
- WR-148 – Gunderson (former Schnitzer)

Grain size is the last priority analyte as discussed in Section 1.3.3. It is likely that large enough sample volumes for grain size analysis will only be obtained at some locations.

Also, due to physical constraints, it may be impossible to deploy sediment traps at some locations. One possible contingency measure is to pump and actively filter sediments from large volumes of stormwater at some locations. This contingency technique is described in the FSP.

2.4 FLOW MEASUREMENTS

Isco Model 750 Area Velocity flow modules were selected to be used in conjunction with the Isco automatic samplers to allow the collection of flow-weighted composites at each sampling location. The flow modules will also continuously record flow data for the duration of sediment trap deployment. As discussed in Section 1.3.4, flow meter precision or performance may not generate accurate discharge volumes for the entire monitoring period and will not be used to determine annualized loading estimates. However, flow data from the period measured will be evaluated in conjunction with modeled discharge volumes modeled from the same period to understand potential variability and accuracy issues associated with estimating annualized loading from modeling methods.

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Table 1-2. Proposed Stormwater Sampling Locations.

Outfall(s)	Facility or Location	River Mile	Land Use	Industrial or Land Use Activities
Industrial Locations (11)				
WR-24	OSM	2.1	Heavy Industrial	Steel manufacturing
WR-121 or WR-123	Schnitzer International Slip	3.7	Heavy Industrial	Metals
WR-108	Schnitzer - Riverside	4	Heavy Industrial	Metals
WR-107	GASCO	6.4	Heavy Industrial	MGP
WR-96	Arkema	7.3	Heavy Industrial	Chemical manufacturing
WR-14	Chevron - Transportation	7.7	Heavy Industrial	Bulk Fuel
WR-161	Portland Shipyard	8.2	Heavy Industrial	Ship maintenance and repair
WR-4	Sulzer Pump	10.4	Heavy Industrial	Manufacturing
WR-145	Gunderson	8.9	Heavy Industrial	Barge and railroad car manufacturing
WR-147	Gunderson (former Schnitzer)	9	Heavy Industrial	Metals handling
Drains to OF-17	GE Decommissioning	9.7	Heavy Industrial	Transformer decommissioning
Land Use Locations (11)				
Hwy 30	Hwy 30	TBD	Major Transportation	Highways
OF-49	City - St. Johns Area	6.5	Residential	Local traffic/residential
WR-67	Siltronic	6.6	Heavy Industrial	Silicon wafer manufacturing
OF-22C, above Hwy 30	City - Forest Park Area	6.9	Open Space (Forest Park)	Forest land
OF-22B	City - Doane Lake Industrial Area	6.9	Heavy Industrial	Chemical manufacturing
OF-M1, above Devine	City - Mocks Bottom Industrial Area	Lagoon	Light Industrial	Various light industrial uses
OF-M2	City - Mocks Bottom Industrial Area	Lagoon	Light Industrial	Trucking and distribution
OF-22	City - Willbridge Industrial Area	7.7	Heavy Industrial	Petroleum/Forest Park drainage
OF-16	City - Heavy Industrial	9.7	Heavy Industrial	Mixed industrial/highway
WR-218	UPRR Albina	10	Heavy Industrial	Railyard
St. Johns Bridge	Highway drainage	5.8	Major Transportation	Highways
Multiple Land Use Locations (2)				

Table 1-2. Proposed Stormwater Sampling Locations.

Outfall(s)	Facility or Location	River Mile	Land Use	Industrial or Land Use Activities
OF-18	City - Multiple Land Uses	9.7	Open Space/Heavy Industrial	Also includes highway
OF-19	City - Multiple Land Uses	8.4	Open Space/Heavy Industrial	Also includes highway
Terminal 4- Recontamination Evaluation (7)				
OF-52C	City - Terminal 4 Industrial Area	4.3	Light Industrial	Mixed industrial
OF-53	City - Residential above Terminal 4	5.1	Residential	Local traffic/residential
WR-183/Basin R	Terminal 4 - Slip 1	4.3	Heavy Industrial - Site Specific	Grains storage/transport
WR-181/Basin Q	Terminal 4 - Slip 1	4.3	Heavy Industrial - Site Specific	Vacant/former grain storage
WR-177/Basin M	Terminal 4 - Slip 1	4.3	Heavy Industrial - Site Specific	Car parking/liquid bulk storage
WR-20/Basin L	Terminal 4 - Wheeler Bay	4.5	Heavy Industrial - Site Specific	Kinder Morgan bulk storage
WR-169/Basin D	Terminal 4 (Toyota)	4.7	Light Industrial	Vacant/former petroleum storage

PORTLAND HARBOR RI/FS

ROUND 2 QUALITY ASSURANCE PROJECT PLAN

ADDENDUM 8: ROUND 3A STORMWATER SAMPLING

DRAFT

DO NOT QUOTE OR CITE
This document is currently under review by US EPA and its federal, state, and tribal partners, and is subject to change in whole or in part.

February 7, 2007

Prepared for:
The Lower Willamette Group

Prepared by:
Integral Consulting Inc.

IC07-0003

TABLE OF CONTENTS

LIST OF ACRONYMS

AAS	atomic absorption spectrometry
CVAAS	cold vapor atomic absorption spectrometry
EPA	Environmental Protection Agency
FSP	field sampling plan
GC/ECD	gas chromatography/electron capture detector
GC/MS	gas chromatography/mass spectrometry
HRGC/HRMS	high resolution gas chromatography/high resolution mass spectrometry
ICP/AES	inductively coupled plasma/atomic emission spectrometry
ICP/MS	inductively coupled plasma/mass spectrometry
LVI	large volume injector
NOAA	National Oceanic & Atmospheric Administration
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PSEP	Puget Sound Estuary Project
QAPP	quality assurance project plan
RI/FS	remedial investigation/feasibility study
SIM	selected ion monitoring
TOC	total organic carbon
TSS	total suspended solids
USGS	U.S. Geological Survey

LIST OF TABLES

1.0 INTRODUCTION

This quality assurance project plan (QAPP) addendum describes procedures that will be used to conduct the chemical analysis of stormwater and sediment samples collected for the stormwater investigation for the Portland Harbor Superfund Site in Portland, Oregon. Round 3A stormwater sampling will be conducted as described in the field sampling plan (FSP; Anchor and Integral 2007). This QAPP addendum is provided as a supplement to the Round 2 QAPP (Integral and Windward 2004). The Round 2 QAPP describes procedures and requirements for the generation of data of documented acceptable quality that will be used for the remedial investigation and feasibility study (RI/FS). This QAPP addendum addresses procedures that will be used for the stormwater investigation that are not described in the Round 2 QAPP, Round 2 QAPP Addendum 1: Surface Water (Integral 2004a), or in the Round 2 QAPP Addendum 2: PCB Congener Analysis in Sediment Samples (Integral 2004b).

The following information is provided in this QAPP addendum:

- **Project Organization** (supplements QAPP Section A4.2): Contact information for laboratory personnel
- **Task Description** (supplements QAPP Section A6): A description of samples to be collected and submitted for analysis
- **Data Quality Indicators** (supplements QAPP Section A7.2): Laboratory control limits for quality control samples will be updated in a revision to this preliminary QAPP Addendum
- **Laboratory Methods** (supplements QAPP Section B4): Laboratory procedures for chemical analysis.
- **Quality Control** (supplements QAPP Section B5)

Additional procedures and criteria related to sample collection and analysis, data quality evaluation, and reporting for Round 2 of the Portland Harbor RI/FS will be completed as described in the Round 2 QAPP.

2.0 PROJECT ORGANIZATION

The organizational structure for activities associated with the Round 3A stormwater investigation is provided in Figure 4-1 of the Draft FSP. Contact information for the laboratories is as follows:

Columbia Analytical Services
Lee Wolf, Quality Assurance Officer
Greg Salata, Laboratory Project Manager
360-577-7222

gsalata@kelso.caslab.com

Vista Analytical Laboratory
Delia Perla Rangel, Quality Assurance Officer
Bill Luksemburg, Project Manager
916-933-1640
bluksemburg@vista-analytical.com

3.0 TASK DESCRIPTION

The Round 3A Stormwater FSP describes the field sampling and laboratory analysis procedures for this investigation. The sampling approach is divided into the following four elements:

- Collection of flow-weighted composite water samples from three storm events including whole water for organic compound analysis and filtered/unfiltered pairs for metals analysis.
- Collection of additional grab samples at 10 of the 31 locations for sampling of filtered/unfiltered pairs of selected organic compounds.
- Collection of sediment trap samples from sediment traps deployed for a minimum of three months
- Collection of continuous flow monitoring at each sampling site for the duration of the sediment trap deployment period.

The proposed sample types, number of samples, and analyses to be conducted are summarized in FSP Tables 2-1 through 2-3. The laboratory methods for analysis and the analyte concentration goals, method detection limits and method reporting limits are included in Tables 3-1a, 3-1b, 3-2a, and 3-2b. Table 3-3 summarizes the sample containers, holding time, and preservatives for this investigation.

4.0 DATA QUALITY INDICATORS

Round 2 QAPP Addenda 1 and 2 include laboratory control limits for quality control samples. Laboratories typically update their control limits on an annual basis. Current laboratory control limits for quality control samples are included in Tables 4-1 and 4-2 of this document.

5.0 LABORATORY METHODS

The laboratory methods for sediment and stormwater samples are included in Tables 3-1a and 3-1b. Sediment and stormwater samples will be analyzed for the following:

- Conventional analyses
- Polychlorinated biphenyl (PCB) congeners

- Organochlorine pesticides
- PCB Aroclors (sediments only)
- Polycyclic aromatic hydrocarbons (PAHs) and phthalate esters
- Metals
- Chlorinated herbicides
- Field parameters (stormwater only)

The total number of samples and the analyses that will be conducted on each sample are indicated in FSP Table 2-2 and Table 5-1 of this document.

5.1. CONVENTIONAL ANALYSES

Conventional analyses of sediment samples will include total organic carbon (TOC), percent solids, and grain size distribution. Conventional analyses of stormwater samples will include TOC and total suspended solids (TSS). EPA and Puget Sound Estuary Program (PSEP) methods will be used as shown in Tables 3-1a and 3-1b.

TOC in sediment samples will be analyzed according to Plumb (1981). Samples will be pretreated with hydrochloric acid to remove inorganic carbon, dried at 70°C, and analyzed by combustion in an induction furnace. TOC in stormwater samples will be analyzed according to EPA Method 415.1 (EPA 2006). Organic carbon in the samples will be oxidized and the evolved CO_2 will be analyzed using an infrared detector. Samples will be pretreated with hydrochloric acid to remove inorganic carbon.

Percent solids in sediment samples will be determined according to PSEP (1986). These results will be used to calculate analyte concentrations on a dry-weight basis and will also be reported in the database.

Grain size analysis will also be completed using PSEP (1986) protocols. Organic material in the samples will not be oxidized prior to analysis. Sieve sizes 4, 10, 18, 35, 60, 120, and 230 will be used to determine gravel and sand fractions, and phi size intervals 4-5, 5-6, 6-7, 7-8, 8-9, 9-10, and >10 will be determined for the silt and clay fractions using the pipette method.

TSS in stormwater samples will be determined gravimetrically according to EPA Method 160.1 (EPA 2006).

5.2. PCB CONGENERS

PCB congener analyses of sediment and stormwater samples will be completed by Vista Analytical (Vista). Sediment and stormwater samples will be analyzed by high-resolution gas chromatography with high-resolution mass spectrometry (HRGC/HRMS) according to EPA Method 1668A (EPA 2006).

5.3. ORGANOCHLORINE PESTICIDES

Organochlorine pesticides in sediment samples will be extracted using Soxhlet extraction procedures followed by Florisil® column clean-up (EPA Method 3620; EPA 2006) and sulfur removal by tetrabutylammonium sulfite (EPA Method 3660; EPA 2006). Sample extracts will be analyzed by gas chromatography with an electron capture detector (GC/ECD).

Organochlorine pesticides will be extracted from stormwater samples using continuous liquid-liquid extraction procedures. Florisil® column clean-up will be performed on the sample extracts and then analyzed by GC/ECD.

5.4. PCB AROCLORS

Sediment samples will be analyzed for PCB Aroclors according to EPA Method 8082 (EPA 2006). Sediment samples will be prepared using Soxhlet extraction (EPA Method 3541; EPA 2006), followed by sulfuric acid cleanup (EPA Method 3665A; EPA 2006), Florisil® cleanup (EPA Method 3620B; EPA 2006), and sulfur removal by tetrabutylammonium sulfite (EPA Method 3660B; EPA 2006). Extracts will be analyzed by GC/ECD.

5.5. PAHs AND PHTHALATE ESTERS

Sediment and stormwater samples will be extracted using continuous liquid-liquid solvent extraction techniques. Sediment extracts will be analyzed for PAHs and phthalate esters by gas chromatography/mass spectrometry (GC/MS) techniques used in conjuction with a Large Volume Injector (LVI) system to enhance sensitivity (EPA Method 8270C; EPA 2006). Stormwater extracts will be analyzed for PAHs by GC/MS with selected ion monitoring (SIM; EPA Method 8270C; EPA 2006).

Stormwater samples will be analyzed for phthalate esters according to EPA Method 525.2 (EPA 1995). This method includes additional precautions in sample handling (e.g., special glassware cleaing) as well as sample preparation procedures (e.g., solid-phase extraction) to optimize the analysis for phthalates and reduce potential sources of laboratory contamination. Sample analysis is completed by GC/MS.

5.6. METALS

Sediment and stormwater samples will be analyzed for total metals according to EPA methodology detailed in Tables 3-1a,b. Strong acid digestion with nitric acid and hydrogen peroxide will be used to prepare samples for analysis of metals other than mercury.

Analyses for antimony, arsenic, cadmium, lead, and silver in sediment samples will be conducted using inductively coupled plasma/mass spectrometry (ICP/MS) according to EPA Method 6020 (EPA 2006). Analyses for aluminum, chromium, copper, nickel, and zinc in sediment samples will be conducted using inductively coupled plasma/atomic emission spectrometry (ICP/AES) according to EPA Method 6010B (EPA 2006). Selenium and arsenic analyses will be conducted using atomic absorption spectrometry (AAS) according to EPA Methods 7742 and 7062, respectively (EPA 2006).

Stormwater samples will be analyzed for total metals by ICP/MS, according to EPA Method 200.8 (EPA 2006).

Sediment and stormwater samples will be analyzed for mercury by extraction with aqua regia and oxidation using potassium permanganate. Analyses will be completed by cold vapor atomic absorption spectrometry (CVAAS) according to EPA Method 7471A (EPA 2006).

5.7. CHLORINATED HERBICIDES

Sediment and stormwater samples will be analyzed for chlorinated herbicides according to EPA Method 8151A (EPA 2006). Sediment samples will be extracted with methanolic potassium hydroxide, then acidified and extracted with ethyl ether and methylene chloride. The extract will be concentrated, and ester derivatives will be formed using diazomethane. Extracts will be analyzed by GC/MS.

Stormwater samples will be adjusted to a pH <2 and extracted with ethyl ether. The extracts will then be hydrolyzed to the acid form by the addition of sodium hydroxide, and ester derivatives will be formed using diazomethane. Extracts will be analyzed by GC/ECD.

5.8. FIELD PARAMETERS

In situ measurements of general water quality characteristics will be taken at all sampling stations, including conductivity, pH, temperature, and turbidity. River flow data will be tracked daily using information obtained from the U.S. Geological Survey (USGS) or National Oceanic & Atmospheric Administration (NOAA) databases.

6.0 QUALITY CONTROL

The field quality control samples and the frequency of collection for the Round 3A stormwater investigation are summarized in Section 3.8 of the Draft FSP and in FSP Table 2-2 and Table 5-1 of this document.

7.0 REFERENCES

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Table 3-1a. Laboratory Methods for Sediment Samples.

Analysis	Laboratory	Sample Preparation		Quantitative Analysis	
		Protocol	**Procedure**	**Protocol**	**Procedure**
Conventional Analyses	CAS				
Total solids		--	--	PSEP 1986	Balance
Grain size		--	--	PSEP 1986	Sieve and pipette method
Total organic carbon		Plumb 1981	Acid pretreatment	Plumb et al. 1981	Combustion; coulometric titration
Metals	CAS				
Antimony, arsenic[1], cadmium, lead, silver		EPA 3050	Strong acid digestion	EPA 6020	ICP/MS
Aluminum, chromium, copper, nickel, zinc		EPA 3050	Strong acid digestion	EPA 6010B	ICP/AES
Selenium		EPA 3050	Strong acid digestion	EPA 7742	AAS
		EPA 7742	Hydride generation		
Arsenic[1]		EPA 3050	Strong acid digestion	EPA 7062	AAS
Mercury		EPA 7471A	Acid digestion/oxidation	EPA 7471A	CVAAS
Chlorinated herbicides	CAS	EPA 8151A	Solvent extraction	EPA 8151A	GC/ECD
			Esterification		
Organochlorine pesticides and selected SVOCs	CAS	EPA 3541	Soxhlet extraction	EPA 8081A	GC/ECD
		EPA 3620B	Florisil® cleanup		
		EPA 3660B	Sulfur cleanup		
PCB Aroclors	CAS	EPA 3541	Soxhlet extraction	EPA 8082	GC/ECD
		EPA 3665A	Sulfuric acid cleanup		
		EPA 3620B	Florisil® cleanup		
		EPA 3660B	Sulfur cleanup		
Semivolatile organic compounds	CAS				
PAHs and phthalates		EPA 3541	Automated Soxhlet Extraction	EPA 8270C	GC/MS-LVI
		EPA 3640A	Gel permeation chromatography		
PCB Congeners[2]	Vista	EPA 1668A	Soxhlet/Dean Stark extraction	EPA 1668A	HRGC/HRMS
			Sulfuric acid cleanup		
			Silica column cleanup		

Notes:

[a] Arsenic will be analyzed by EPA Method 7062 if it is not detected at the MRL by EPA Method 6020.

[b] Analysis will be completed for all 209 PCB congeners.

AAS - atomic absorption spectrometry
CAS - Columbia Analytical Services
CVAAS - cold vapor atomic absorption spectrometry
EPA - U.S. Environmental Protection Agency
GC/ECD - gas chromatography/electron capture detection
GC/MS - gas chromatography/mass spectrometry
HRGC/HRMS - high-resolution gas chromatography/high-resolution mass spectrometry
ICP/AES - inductively coupled plasma/atomic emission spectrometry
ICP/MS - inductively coupled plasma/mass spectrometry
LVI - large-volume injector
PAH - polycyclic aromatic hydrocarbon
PCB - polychlorinated biphenyl
PSEP - Puget Sound Estuary Program
SVOC - semivolatile organic compound

Table 3-1b. Laboratory Methods for Water Samples.

Analytes	Laboratory	Sample Preparation		Quantitative Analysis	
		Protocol	**Procedure**	**Protocol**	**Procedure**
Conventional Analyses	CAS				
Total Suspended Solids		EPA 160.2	Filtration and drying	EPA 160.2	Balance
Total Organic Carbon		EPA 415.1	Chemical oxidation	EPA 415.1	Infrared detector
Metals	CAS				
Aluminum, antimony, cadmium, total chromium, copper, lead, nickel, selenium, silver, zinc		EPA 3005	Acid digestion	EPA 200.8	ICP/MS
Arsenic		EPA 3005A (Modified)	Acid Digestion/pre-concentration	EPA 200.8	ICP/MS
Mercury		EPA 7470	Acid digestion/oxidation	EPA 7470	CVAAS
Phthalate Esters	CAS	EPA 525.2	Solid-phase extraction	EPA 525.2	GC/MS
Chlorinated Herbicides	CAS	EPA 8151A	Solvent extraction	EPA 8151A	GC/ECD
			Esterification		
Organochlorine pesticides and selected SVOCs	CAS	EPA 3545	Pressurized fluid extraction	EPA 8081A	GC/ECD
		EPA 3640A	Gel permeation chromatography		
		EPA 3630C	Florisil® cleanup		
		EPA 3660B	Sulfur cleanup (as needed)		
Polycyclic Aromatic Hydrocarbons	CAS	EPA 3520C	Continuous liquid-liquid extraction	EPA 8270C	GC/MS-SIM
PCB congeners [1]	Vista	EPA 1668A	Florisil® cleanup	EPA 1668A	HRGC/HRMS
			Extract fractionation		
			Layered Acid/Base SiO_3 Alumina		

Notes:

[1] Includes all 209 congeners.

CAS - Columbia Analytical Services
CVAAS - cold vapor atomic absorption spectrometry
EPA - U.S. Environmental Protection Agency
GC/ECD - gas chromatography/electron capture detection
GC/MS - gas chromatography/mass spectrometry
HRGC/HRMS - high resolution gas chromatography/high resolution mass spectrometry
ICP/MS - inductively coupled plasma/mass spectrometry
PCB - polychlorinated biphenyl
SIM - selected ion monitoring
SVOC - semivolatile organic compound

Table 3-2a. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Sediment Samples.

Analytes	Congener number (PCBs only)	ACG[a]	MDL	MRL[b]
Conventional Analyses				
Total solids (percent of whole weight)		*	0.01	0.01
Grain size (percent)[c]		*	0.1	0.1
Total organic carbon (percent)		*	0.02	0.05
Metals, mg/kg dry wt				
Aluminum		*	10.0	10.0
Antimony		*	0.02	0.05
Arsenic		*	0.07	0.5
Cadmium		*	0.007	0.05
Chromium		*	0.6	2.0
Copper		*	2.0	2.0
Lead		*	0.02	0.05
Mercury		*	0.008	0.02
Nickel		*	3.0	4.0
Selenium		*	0.2	1
Silver		*	0.003	0.02
Zinc		*	0.5	2.0
Chlorinated Herbicides, µg/kg dry wt				
2,4,5-T		**2.8**	5.9	50
2,4,5-TP (Silvex)		**2.2**	3.9	50
2,4-D		**2.8**	8	50
2,4-DB		**2.2**	9.7	50
Dalapon		*	7	50
Dicamba		*	5.4	50
Dichlorprop		*	9.5	50
Dinoseb		*	3.5	50
MCPA		*	520	10000
MCPP		*	530	10000
Organochlorine Pesticides and Selected SVOCs, µg/kg dry wt				
2,4'-DDD		*	0.02	0.13
2,4'-DDE		*	0.009	0.13
2,4'-DDT		*	0.01	0.13
4,4'-DDD		**0.083**	0.012	0.13
4,4'-DDE		**0.0588**	0.01	0.13
4,4'-DDT		**0.0588**	0.021	0.13
Total DDT		*	--	--
Aldrin		**0.00038**	0.031	0.13
alpha-BHC		**0.001**	0.01	0.13
beta-BHC		**0.0036**	0.028	0.13
delta-BHC		*	0.018	0.13
gamma-BHC (Lindane)		**0.005**	0.012	0.13
alpha-Chlordane		*	0.008	0.13
gamma-Chlordane		*	0.005	0.13
Oxychlordane		*	0.012	0.13

Table 3-2a. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Sediment Samples.

Analytes	Congener number (PCBs only)	ACG[a]	MDL	MRL[b]
cis -Nonachlor		*	0.005	0.13
trans -Nonachlor		*	0.004	0.13
Total chlordane[d]		**0.057**	--	--
Dieldrin		**0.0004**	0.01	0.13
Endosulfan I		1.7	0.014	0.13
Endosulfan II		*	0.008	0.13
Endosulfan sulfate		*	0.026	0.13
Endrin		**0.084**	0.03	0.13
Endrin aldehyde		*	0.02	0.13
Endrin ketone		*	0.007	0.13
Heptachlor		**0.0014**	0.012	0.13
Heptachlor epoxide		**0.0007**	0.018	0.13
Methoxychlor		1.4	0.024	0.13
Mirex		**0.056**	0.007	0.13
Toxaphene		**0.0059**	0.9	10
Hexachlorobenzene		0.33	0.02	0.2
Hexachlorobutadiene		0.6	0.12	0.2
Hexachloroethane		2.0	0.12	0.2
Semivolatile Organic Compounds, µg/kg dry wt				
Polycyclic Aromatic Hydrocarbons				
2-Methylnaphthalene		*	1.2	10
Acenaphthene		72	1	10
Acenaphthylene		*	1.4	10
Anthracene		360	1.4	10
Benz(a)anthracene		**0.038**	1.4	10
Benzo(a)pyrene		**0.0038**	1.6	10
Benzo(b)fluoranthene		**0.038**	2.5	10
Benzo(g,h,i)perylene		*	2.3	10
Benzo(k)fluoranthene		**0.38**	2.5	10
Chrysene		**3.8**	1.4	10
Dibenz(a,h)anthracene		**0.0038**	2.2	10
Dibenzofuran		8.2	1.3	10
Fluoranthene		48	2.2	10
Fluorene		48	1.7	10
Indeno(1,2,3-cd)pyrene		**0.038**	1.9	10
Naphthalene		24	1.3	10
Phenanthrene		*	1.3	10
Pyrene		36	1.3	10
Phthalates				
Bis(2-ethylhexyl) phthalate		**3.4**	1.7	200
Butylbenzyl phthalate		400	1.5	10
Dibutyl phthalate		204	2.6	10
Diethyl phthalate		*	3.5	10
Dimethyl phthalate		20000	1.8	10
Di-n-octyl phthalate		40.9	1.2	10

Table 3-2a. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Sediment Samples.

Analytes	**Congener number (PCBs only)**	**ACG[a]**	**MDL**	**MRL[b]**
PCB congeners				
Dioxin-like PCB congeners (WHO list)	**Congener number**			
3,3',4,4'-TetraCB	PCB-77	10	1.1	5
3,4,4',5-TetraCB	PCB-81	10	1.0	5
2,3,3'4,4'-PentaCB	PCB-105	10	0.9	5
2,3,4,4',5-PentaCB	PCB-114	2	0.7	5
2,3',4,4',5-PentaCB	PCB-118	10	2.1	5
(coelution with 2,3,3',4,5-PentaCB)	(coelution with PCB 106)			
2',3,4,4',5-PentaCB	PCB-123	10	0.9	5
3,3',4,4',5-PentaCB	PCB-126	0.01	0.6	5
2,3,3',4,4',5-HexaCB	PCB-156	2	0.8	5
2,3,3',4,4',5'-HexaCB	PCB-157	2	0.6	5
2,3,4,4',5,5'-HexaCB	PCB-167	100	0.5	5
3,3',4,4',5,5'-HexaCB	PCB-169	0.1	0.8	5
2,3,3',4,4',5,5'-HeptaCB	PCB-189	10	0.3	5
Other PCB congeners				
2-MonoCB	PCB-1		0.5	2.5
3-MonoCB	PCB-2		0.6	2.5
4-MonoCB	PCB-3		0.6	2.5
2,2'-DiCB/2,6-DiCB	PCB-4/10		4.3	2.5
2,3-DiCB/2,4'-DiCB	PCB-5/8		4.4	2.5
2,3'-DiCB	PCB-6		2.2	2.5
2,4-DiCB/2,5-DiCB	PCB-7/9		4.6	2.5
3,3'-DiCB	PCB-11		5.0	2.5
3,4-DiCB/3,4'-DiCB	PCB-12/13		6.1	2.5
3,5-DiCB	PCB-14		3.0	2.5
4,4'-DiCB	PCB-15		2.8	2.5
2,2',3-TriCB/2,4',6-TriCB	PCB-16/32		2.5	2.5
2,2',4-TriCB	PCB-17		1.3	2.5
2,2',5-TriCB	PCB-18		1.4	2.5
2,2',6-TriCB	PCB-19		1.0	2.5
2,3,3'-TriCB/2,3,4-TriCB/2,3,5-TriCB	PCB-20/21/33		1.4	2.5
2,3,4'-TriCB	PCB-22		0.9	2.5
2,3,5-TriCB	PCB-23		0.7	2.5
2,3,6-TriCB/2,3',6-TriCB	PCB-24/27		2.5	2.5
2,3',4-TriCB	PCB-25		0.8	2.5
2,3',5-TriCB	PCB-26		0.8	2.5
2,4,4'-TriCB	PCB-28		1.5	2.5
2,4,5-TriCB	PCB-29		0.6	2.5
2,4,6-TriCB	PCB-30		0.9	2.5
2,4',5-TriCB	PCB-31		1.2	2.5
2',3,5-TriCB	PCB-34		0.9	2.5
3,3',4-TriCB	PCB-35		0.4	2.5

Table 3-2a. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Sediment Samples.

Analytes	**Congener number (PCBs only)**	**ACG[a]**	**MDL**	**MRL[b]**
3,3',5-TriCB	PCB-36		0.9	2.5
3,4,4'-TriCB	PCB-37		0.6	2.5
3,4,5-TriCB	PCB-38		0.9	2.5
3,4',5-TriCB	PCB-39		0.6	2.5
2,2',3,3'-TetraCB	PCB-40		1.2	5
2,2',3,4-TetraCB/2,3,4',6-TetraCB/2,3',4',6-TetraCB/2,3',5,5'-TetraCB	PCB-41/64/71/72		3.5	5
2,2',3,4'-TetraCB/2,3,3',6-TetraCB	PCB-42/59		2.0	5
2,2',3,5-TetraCB/2,2',4,5'-TetraCB	PCB-43/49		2.2	5
2,2',3,5'-TetraCB	PCB-44		5.3	5
2,2',3,6-TetraCB	PCB-45		1.3	5
2,2',3,6'-TetraCB	PCB-46		1.1	5
2,2',3,4'-TetraCB	PCB-47		3.4	5
2,2',4,5-TetraCB/2,4,4',6-TetraCB	PCB-48/75		1.8	5
2,2',4,6-TetraCB	PCB-50		1.5	5
2,2',4,6'-TetraCB	PCB-51		1.1	5
2,2',5,5'-TetraCB/2,3',4,6-TetraCB	PCB-52/69		3.3	5
2,2',5,6'-TetraCB	PCB-53		1.0	5
2,2',6,6'-TetraCB	PCB-54		1.9	5
2,3,3',4'-TetraCB	PCB-55		1.0	5
2,3,3',4'-TetraCB/2,3,4,4'-TetraCB	PCB-56/60		2.5	5
2,3,3',5-TetraCB	PCB-57		1.2	5
2,3,3',5'-TetraCB	PCB-58		1.2	5
2,3,4,5-TetraCB	PCB-61		1.2	5
2,3,4,6-TetraCB	PCB-62		0.9	5
2,3,4',5-TetraCB	PCB-63		1.1	5
2,3,5,6-TetraCB	PCB-65		1.3	5
2,3',4,4'-TetraCB	PCB-66		1.8	5
2,3',4,5-TetraCB	PCB-67		1.2	5
2,3',4,5'-TetraCB	PCB-68		1.3	5
2,3',4',5-TetraCB	PCB-70		1.4	5
2,3',5',6-TetraCB	PCB-73		0.7	5
2,4,4',5-TetraCB	PCB-74		1.1	5
2',3,4',5-TetraCB	PCB-76		2.3	5
3,3',4,5-TetraCB	PCB-78		2.8	5
3,3',4,5'-TetraCB	PCB-79		1.7	5
3,3',5,5'-TetraCB	PCB-80		0.9	5
2,2',3,3',4-PentaCB	PCB-82		1.3	5
2,2',3,3',5-PentaCB	PCB-83		0.9	5
2,2',3,3',6-PentaCB/2,2',3,5,5'-Pent	PCB-84/92		1.6	5
2,2',3,4,4'-PentaCB/2,3,4,5,6-Penta	PCB-85/116		1.3	5
2,2',3,4,5-PentaCB	PCB-86		1.8	5
2,2',3,4,5'-PentaCB/2,3,4',5,6-PentaCB/2',3,4,5,6'-PentaCB	PCB-87/117/125		1.8	5
2,2',3,4,6-PentaCB/2,2',3,4',6-Penta	PCB-88/91		1.6	5

Table 3-2a. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Sediment Samples.

Analytes	**Congener number (PCBs only)**	**ACG[a]**	**MDL**	**MRL[b]**
2,2',3,4,6'-PentaCB	PCB-89		0.7	5
2,2',3,4',5-PentaCB/2,2',4,5,5'-Pent	PCB-90/101		1.5	5
2,2',3,5,6-PentaCB	PCB-93		1.5	5
2,2',3,5,6'-PentaCB	PCB-94		0.4	5
2,2',3,5',6-PentaCB/2,2',3',4,6-PentaCB/2,2',4,5,6'-PentaCB	PCB-95/98/102		6.4	5
2,2',3,6,6'-PentaCB	PCB-96		0.5	5
2,2',3',4,5-PentaCB	PCB-97		1.3	5
2,2',4,4',5-PentaCB	PCB-99		1.0	5
2,2',4,4',6-PentaCB	PCB-100		0.3	5
2,2',4,5,6'-PentaCB	PCB-103		0.4	5
2,2',4,6,6'-PentaCB	PCB-104		0.5	5
2,3,3',4',5-PentaCB/2,3,3',4,6-PentaCB	PCB-107/109		1.3	5
2,3,3',4,5'-PentaCB/2,3,3',5,6-PentaCB	PCB-108/112		1.0	5
2,3,3',4',6-PentaCB	PCB-110		1.8	5
2,3,3',5,5'-PentaCB/2,3,4,4',6-PentaCB	PCB-111/115		1.7	5
2,3,3',5',6-PentaCB	PCB-113		1.0	5
2,3',4,4',6-PentaCB	PCB-119		0.9	5
2,3',4,5,5'-PentaCB	PCB-120		1.0	5
2,3',4,5,6-PentaCB	PCB-121		0.9	5
2',3,3',4,5-PentaCB	PCB-122		1.0	5
2',3,4,5,5'-PentaCB	PCB-124		1.1	5
3,3',4,5,5'-PentaCB	PCB-127		0.8	5
2,2',3,3',4,4'-HexaCB/2,3,3',4',5,5'-HexaCB	PCB-128/162		1.2	5
2,2',3,3',4,5-HexaCB	PCB-129		0.8	5
2,2',3,3',4,5'-HexaCB	PCB-130		0.8	5
2,2',3,3',4,6-HexaCB	PCB-131		2.5	5
2,2',3,3',4,6'-HexaCB/2,3,3',4,5',6-HexaCB	PCB-132/161		1.0	5
2,2',3,3',5,5'-HexaCB/2,2',3,4,5,6-HexaCB	PCB-133/142		3.9	5
2,2',3,3',5,6-HexaCB/2,2',3,4,5,6'-HexaCB	PCB-134/143		4.1	5
2,2',3,3',5,6'-HexaCB	PCB-135		1.4	5
2,2',3,3',6,6'-HexaCB	PCB-136		1.2	5
2,2',3,4,4',5-HexaCB	PCB-137		1.0	5
2,2',3,4,4',5'-HexaCB/2,3,3',4',5,6-HexaCB/2,3,3',4',5',6-HexaCB	PCB-138/163/164		2.1	5
2,2',3,4,4',6-HexaCB/2,2',3,4',5',6-HexaCB	PCB-139/149		1.8	5
2,2',3,4,4',6'-HexaCB	PCB-140		1.0	5
2,2',3,4,5,5'-HexaCB	PCB-141		0.6	5

Table 3-2a. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Sediment Samples.

Analytes	**Congener number (PCBs only)**	**ACG[a]**	**MDL**	**MRL[b]**
2,2',3,4,5',6-HexaCB	PCB-144		1.7	5
2,2',3,4,6,6'-HexaCB	PCB-145		1.1	5
2,2',3,4',5,5'-HexaCB/2,3,3',5,5',6-HexaCB	PCB-146/165		1.7	5
2,2',3,4',5,6-HexaCB	PCB-147		0.7	5
2,2',3,4',5,6'-HexaCB	PCB-148		1.1	5
2,2',3,4',6,6'-HexaCB	PCB-150		1.3	5
2,2',3,5,5',6-HexaCB	PCB-151		1.5	5
2,2',3,5,6,6'-HexaCB	PCB-152		1.3	5
2,2',4,4',5,5'-HexaCB	PCB-153		1.2	5
2,2',4,4',5',6-HexaCB	PCB-154		1.1	5
2,2',4,4',6,6'-HexaCB	PCB-155		0.9	5
2,3,3',4,4',6-HexaCB/2,3,3',4,5,6-HexaCB	PCB-158/160		1.3	5
2,3,3',4,5,5'-HexaCB	PCB-159		0.5	5
2,3,4,4',5,6-HexaCB	PCB-166		0.6	5
2,3',4,4',5',6-HexaCB	PCB-168		0.4	5
2,2',3,3',4,4',5-HeptaCB	PCB-170		0.4	5
2,2',3,3',4,4',6-HeptaCB	PCB-171		0.6	5
2,2',3,3',4,5,5'-HeptaCB	PCB-172		0.5	5
2,2',3,3',4,5,6-HeptaCB	PCB-173		0.7	5
2,2',3,3',4,5,6'-HeptaCB	PCB-174		1.4	5
2,2',3,3',4,5',6-HeptaCB	PCB-175		1.2	5
2,2',3,3',4,6,6'-HeptaCB	PCB-176		0.4	5
2,2',3,3',4',5,6-HeptaCB	PCB-177		0.7	5
2,2',3,3',5,5',6-HeptaCB	PCB-178		0.6	5
2,2',3,3',5,6,6'-HeptaCB	PCB-179		0.3	5
2,2',3,4,4',5,5'-HeptaCB	PCB-180		0.7	5
2,2',3,4,4',5,6-HeptaCB	PCB-181		0.8	5
2,2',3,4,4',5,6'-HeptaCB/2,2',3,4,5,5',6-HeptaCB	PCB-182/187		1.1	5
2,2',3,4,4',5',6-HeptaCB	PCB-183		0.6	5
2,2',3,4,4',6,6'-HeptaCB	PCB-184		0.5	5
2,2',3,4,5,5',6-HeptaCB	PCB-185		0.6	5
2,2',3,4,5,6,6'-HeptaCB	PCB-186		0.8	5
2,2',3,4',5,6,6'-HeptaCB	PCB-188		0.5	5
2,3,3',4,4',5,6-HeptaCB	PCB-190		0.7	5
2,3,3',4,4',5',6-HeptaCB	PCB-191		0.5	5
2,3,3',4,5,5',6-HeptaCB	PCB-192		0.8	5
2,3,3',4',5,5',6-HeptaCB	PCB-193		0.5	5
2,2',3,3',4,4',5,5'-OctaCB	PCB-194		0.9	7.5
2,2',3,3',4,4',5,6-OctaCB	PCB-195		2.1	7.5
2,2',3,3',4,4',5,6'-OctaCB/2,2',3,4,4',5,5',6-OctaCB	PCB-196/203		2.3	7.5
2,2',3,3',4,4',6,6'-OctaCB	PCB-197		0.9	7.5
2,2',3,3',4,5,5',6-OctaCB	PCB-198		1.4	7.5

Table 3-2a. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Sediment Samples.

Analytes	Congener number (PCBs only)	ACG[a]	MDL	MRL[b]
2,2',3,3',4,5,5',6'-OctaCB	PCB-199		1.5	7.5
2,2',3,3',4,5,6,6'-OctaCB	PCB-200		1.2	7.5
2,2',3,3',4,5',6,6'-OctaCB	PCB-201		1.1	7.5
2,2',3,3',5,5',6,6'-OctaCB	PCB-202		0.6	7.5
2,2',3,4,4',5,6,6'-OctaCB	PCB-204		0.7	7.5
2,3,3',4,4',5,5',6-OctaCB	PCB-205		1.2	7.5
2,2',3,3',4,4',5,5',6-NonaCB	PCB-206		0.5	7.5
2,2',3,3',4,4',5,6,6'-NonaCB	PCB-207		0.5	7.5
2,2',3,3',4,5,5',6,6'-NonaCB	PCB-208		0.7	7.5
DecaCB	PCB-209		0.9	7.5

Notes: Sed table

* A risk-based ACG has not been established.

[a] Values are provided in bold font when the MRL is not expected to meet the ACG.

[b] The MRL is provided on a dry-weight basis and assumes 50% moisture in the samples.
The MRL for project samples will vary with moisture content in the samples.
The MRL represents the level of lowest calibration standard (i.e., the practical quantitation limit).

[c] Grain-size intervals will include the following:

Gravel	Fine sand	Fine silt
Very coarse sand	Very fine sand	Very fine silt
Coarse sand	Coarse silt	Clay, phi size >8
Medium sand	Medium silt	

[d] Total chlordane will be calculated as the sum of the five components listed above this entry.

ACG = Analytical concentration goal; ACGs were established by EPA during *ad hoc* meeting with LWG on May 10, 2002

MDL = Method detection limit
MRL = Method reporting limit

PCB - polychlorinated biphenyl

Notes: Congener table

[1] ACGs for the dioxin-like congeners are based on the ACG of 0.01 pg/g dry wt for PCB-126 from the Round 1 QAPP and adjusted using the WHO TEFs.

[2] The MRLs and MDLs are provided on a dry-weight basis and assume 50% moisture in the samples and a sample weight of 10 or 50 g, as noted.
The MRL represents the level of lowest calibration standard (i.e., the practical quantitation limit).
Sample-specific MDLs are reported with the final data and will vary based on sample size and characteristics.

ACG = Analytical concentration goal
MDL = Method detection limit
MRL = Method reporting limit
tbd = to be determined
TEF = Toxicity equivalent factor
WHO = World Health Organization

Table 3-2b. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Water Samples.

Analytes	Congener number (PCBs only)	Ecological Screening Values		Human Health Screening Values			Analytical Concentration Goals			MDLs and MRLs	
		AWQC [1]	ORNL [2]	EPA Region 9 Tap water PRG [3]	Fish Consumption Only [4]	Site-Specific Fish Consumption Only [5]	Level 1 ACG [6]	Level 2 ACG [7]	Level 3 ACG [8]	MDL	MRL
Conventional Analyses, mg/L (ppm)											
Total suspended solids							1 [9]	1 [9]	1 [9]	1	1
Total organic carbon							NE	NE	NE	0.07	0.5
Metals/Inorganics, mg/L (ppm)											
Aluminum		0.087	0.46	36			0.087	0.087	0.087	0.0007	0.002
Antimony			0.61	0.015	0.64	0.064	0.015	0.015	0.015	0.00002	0.00005
Arsenic		0.15	0.914	0.000045	0.00014	0.000014	0.000045	0.000045	0.000014	TBD	0.00005
Cadmium [10]		0.000094	0.00015	0.018			0.000094	0.000094	0.000094	0.00001	0.00002
Chromium, total							NE	NA	NA	0.00006	0.0002
Copper [10]		0.00274	0.00023	1.5			0.00023	0.00023	0.00023	0.00004	0.0001
Lead [10]		0.000541	0.012				0.000541	0.000541	0.000541	0.00001	0.00002
Mercury		0.00077	<0.00023	0.011			<0.00023	<0.00023	<0.00023	0.0001	0.0002
Nickel [10]		0.016	<0.005	0.73	4.6	0.46	<0.005	<0.005	<0.005	0.00004	0.0002
Selenium		0.005	0.0883	0.18	4.2	0.42	0.005	0.005	0.005	0.0002	0.001
Silver			0.00012	0.18			0.00012	0.00012	0.00012	0.00001	0.00002
Zinc [10]		0.0365	0.03	11	26	2.6	0.03	0.03	0.03	0.0002	0.0005
Chlorinated Herbicides, µg/L (ppb)											
Dalapon				1100			1100	1100	1100	0.06	0.4
Dicamba				1100			1100	1100	1100	0.071	0.4
MCPA							NE	NE	NE	24	100
Dichlorprop							NE	NE	NE	0.061	0.4
2,4-D				360			360	360	360	0.079	0.4
2,4,5-TP (Silvex)				290			290	290	290	0.085	0.2
2,4,5-T				360			360	360	360	0.017	0.2
2,4-DB				290			290	290	290	0.13	0.4
Dinoseb				36			36	36	36	0.091	0.2
MCPP				360			360	360	360	23	100
Organochlorine Pesticides, µg/L (ppb)											

Table 3-2b. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Water Samples.

		Ecological Screening Values		Human Health Screening Values			Analytical Concentration Goals			MDLs and MRLs	
Analytes	**Congener number (PCBs only)**	**AWQC [1]**	**ORNL [2]**	**EPA Region 9 Tap water PRG [3]**	**Fish Consumption Only [4]**	**Site-Specific Fish Consumption Only [5]**	**Level 1 ACG [6]**	**Level 2 ACG [7]**	**Level 3 ACG [8]**	**MDL**	**MRL**
2,4'-DDD							0.28	0.28	0.28	TBD	0.0005
2,4'-DDE							0.2	0.2	0.2	TBD	0.0005
2,4'-DDT							0.2	0.2	0.2	TBD	0.0005
4,4'-DDD			0.011	0.28	0.00031	0.0000	0.280	0.00031	0.000031	TBD	0.0005
4,4'-DDE				0.2	0.00022	0.0000	0.2	0.00022	0.000022	TBD	0.0005
4,4'-DDT		0.001	0.013	0.2	0.00022	0.0000	0.001	0.00022	0.000022	TBD	0.0005
Total DDT				0.2			NE	NE	NE	NE	NE
Aldrin				0.004	0.00005	0.000005	0.004	0.00005	0.000005	TBD	0.0005
alpha-BHC			2.2	0.011	0.0049	0.00049	0.004	0.0049	0.00049	TBD	0.0005
beta-BHC				0.037	0.017	0.0017	0.004	0.017	0.0017	TBD	0.0005
delta-BHC				0.037			0.004	0.004	0.004	TBD	0.0005
gamma-BHC (Lindane)		0.08		0.052	1.8	0.18	0.052	0.052	0.0063	TBD	0.0005
alpha-Chlordane							0.0043	0.00081	0.000081	TBD	0.0005
gamma-Chlordane							0.0043	0.00081	0.000081	TBD	0.0005
Oxychlordane				0.19			0.19	0.19	0.19	TBD	0.0005
cis -Nonachlor				0.19			0.19	0.19	0.19	TBD	0.0005
trans -Nonachlor				0.19			0.19	0.19	0.19	TBD	0.0005
Total Chlordane [a]		0.0043		0.19	0.00081	0.000081	NE	NE	NE	NE	NE
Dieldrin		0.0019	0.051	0.0042	0.000054	0.0000054	0.0042	0.000054	0.0000054	TBD	0.0005
Endosulfan I		0.056	0.051	220	89	8.9	0.051	0.051	8.9	TBD	0.0005
Endosulfan II		0.056		220	89	8.9	0.051	0.051	0.051	TBD	0.0005
Endosulfan sulfate					89	8.9	NE	89	8.9	TBD	0.0005
Endrin		0.0023	0.061	11	0.06	0.006	0.036	0.036	0.006	TBD	0.0005
Endrin aldehyde					0.3	0.03	NE	0.3	0.03	TBD	0.0005
Endrin ketone							NE	NE	NE	TBD	0.0005
Heptachlor		0.0038	0.0069	0.015	0.000079	0.0000079	0.0038	0.000079	0.0000079	TBD	0.0005
Heptachlor epoxide		0.0038		0.0074	0.000039	0.0000039	0.0038	0.000039	0.0000039	TBD	0.0005
Methoxychlor		0.03	0.019	180			0.019	0.019	0.019	TBD	0.0005

Table 3-2b. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Water Samples.

		Ecological Screening Values		Human Health Screening Values			Analytical Concentration Goals			MDLs and MRLs	
Analytes	**Congener number (PCBs only)**	**AWQC [1]**	**ORNL [2]**	**EPA Region 9 Tap water PRG [3]**	**Fish Consumption Only [4]**	**Site-Specific Fish Consumption Only [5]**	**Level 1 ACG [6]**	**Level 2 ACG [7]**	**Level 3 ACG [8]**	**MDL**	**MRL**
Mirex							NE	NE	NE	NE	NE
Toxaphene		0.0002		0.061	0.00028	0.000028	0.0002	0.0002	0.000028	TBD	0.025
Hexachlorobenzene							0.042	0.00029	0.000029	TBD	0.0005
Hexachlorobutadiene							0.86	0.86	0.86	TBD	0.001
Hexachloroethane											
Semivolatile Organic Compounds, µg/L (ppb)											
Polycyclic Aromatic Hydrocarbons											
Naphthalene			620	6.2			6.2	6.2	6.2	0.014	0.02
2-Methylnaphthalene							NE	NE	NE	0.012	0.02
Acenaphthylene							NE	NE	NE	0.0089	0.02
Acenaphthene		23	74	370	990	99	23	23	23	0.0097	0.02
Fluorene		3.9		240	5300	530	3.9	3.9	3.9	0.011	0.02
Phenanthrene		6.3	200				6.3	6.3	6.3	0.013	0.02
Anthracene		0.73	0.09	1800	40000	4000	0.09	0.09	0.09	0.01	0.02
Fluoranthene		6.2	15	1500	140	14	6.2	6.2	6.2	0.013	0.02
Pyrene				180	4000	400	180	180	180	0.012	0.02
Benz(a)anthracene		0.027	0.65	0.092	0.018	0.0018	0.027	0.018	0.0018	0.013	0.02
Chrysene				9.2	0.018	0.0018	9.2	0.018	0.0018	0.012	0.02
Benzo(b)fluoranthene				0.092	0.018	0.0018	0.092	0.018	0.0018	0.0098	0.02
Benzo(k)fluoranthene				0.92	0.018	0.0018	0.92	0.018	0.0018	0.011	0.02
Benzo(a)pyrene		0.14	0.3	0.0092	0.018	0.0018	0.0092	0.0092	0.0018	0.0087	0.02
Indeno(1,2,3-cd)pyrene				0.092	0.018	0.0018	0.092	0.018	0.0018	0.0087	0.02
Dibenz(a,h)anthracene				0.0092	0.018	0.0018	0.0092	0.0092	0.0018	0.0079	0.02
Benzo(g,h,i)perylene							NE	NE	NE	0.009	0.02
Phthalate Esters, µg/L (ppb)											
Dimethylphthalate		3		360000	1100000	110000	3	3	3	0.015	0.5
Diethylphthlalate		3	85,600	29000	44000	4400	3	3	3	0.007	0.5
Di-n-butylphthalate		1.0		3600	4500	450	1	1	1	0.013	0.6

Table 3-2b. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Water Samples.

		Ecological Screening Values		**Human Health Screening Values**			**Analytical Concentration Goals**			**MDLs and MRLs**	
Analytes	**Congener number (PCBs only)**	**AWQC [1]**	**ORNL [2]**	**EPA Region 9 Tap water PRG [3]**	**Fish Consumption Only [4]**	**Site-Specific Fish Consumption Only [5]**	**Level 1 ACG [6]**	**Level 2 ACG [7]**	**Level 3 ACG [8]**	**MDL**	**MRL**
Butylbenzylphthalate		3		7300	1900	190	3	3	3	0.013	0.5
Di-n-octylphthalate		3		1500			3	3	3	0.005	0.1
Bis-(2-ethylhexyl) phthalate		0.12	912	4.8	2.2	0.22	0.12	0.12	0.12	0.049	0.5
PCB congeners, pg/L (ppq)											
2-MonoCB	PCB-1									2.4	5.0 - 10
3-MonoCB	PCB-2									1.1	5.0 - 10
4-MonoCB	PCB-3									2.0	5.0 - 10
2,2'-DiCB	PCB-4									1.7	5.0 - 10
2,3-DiCB	PCB-5									1.4	5.0 - 10
2,3'-DiCB	PCB-6									2.0	5.0 - 10
2,4-DiCB	PCB-7									4.0	5.0 - 10
2,4'-DiCB	PCB-8									2.7	5.0 - 10
2,5-DiCB	PCB-9									2.4	5.0 - 10
2,6-DiCB	PCB-10									4.0	5.0 - 10
3,3'-DiCB	PCB-11									9.5	5.0 - 10
3,4-DiCB/3,4'-DiCB	PCB-12/13									5.1	5.0 - 10
3,5-DiCB	PCB-14									3.1	5.0 - 10
4,4'-DiCB	PCB-15									2.2	5.0 - 10
2,2',3-TriCB	PCB-16									1.4	5.0 - 10
2,2',4-TriCB	PCB-17									2.0	5.0 - 10
2,2',5-TriCB/2,4,6-TriCB	PCB-18/30									3.4	5.0 - 10
2,2',6-TriCB	PCB-19									2.8	5.0 - 10
2,3,3'-TriCB/2,4,4'-TriCB	PCB-20/28									3.9	5.0 - 10
2,3,4-TriCB/2,3,5-TriCB	PCB-21/33									3.9	5.0 - 10
2,3,4'-TriCB	PCB-22									2.7	5.0 - 10
2,3,5-TriCB	PCB-23									3.9	5.0 - 10
2,3,6-TriCB	PCB-24									2.6	5.0 - 10
2,3',4-TriCB	PCB-25									3.3	5.0 - 10
2,3',5-TriCB/2,4,5-TriCB	PCB-26/29									4.7	5.0 - 10
2,3',6-TriCB	PCB-27									2.5	5.0 - 10

Table 3-2b. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Water Samples.

		Ecological Screening Values		Human Health Screening Values			Analytical Concentration Goals			MDLs and MRLs	
Analytes	**Congener number (PCBs only)**	**AWQC [1]**	**ORNL [2]**	**EPA Region 9 Tap water PRG [3]**	**Fish Consumption Only [4]**	**Site-Specific Fish Consumption Only [5]**	**Level 1 ACG [6]**	**Level 2 ACG [7]**	**Level 3 ACG [8]**	**MDL**	**MRL**
2,4',5-TriCB	PCB-31									4.5	5.0 - 10
2,4',6-TriCB	PCB-32									2.2	5.0 - 10
2',3,5-TriCB	PCB-34									2.1	5.0 - 10
3,3',4-TriCB	PCB-35									4.3	5.0 - 10
3,3',5-TriCB	PCB-36									4.0	5.0 - 10
3,4,4'-TriCB	PCB-37									2.8	5.0 - 10
3,4,5-TriCB	PCB-38									2.5	5.0 - 10
3,4',5-TriCB	PCB-39									3.5	5.0 - 10
2,2',3,3'-TetraCB/2,2',3,4-TetraCB/2,3',4',6-TetraCB	PCB-40/41/71									5.3	5.0 - 10
2,2',3,4'-TetraCB	PCB-42									3.7	5.0 - 10
2,2',3,5-TetraCB	PCB-43									5.2	5.0 - 10
2,2',3,5'-TetraCB/2,2',4,4'-TetraCB/2,3,5,6-TetraCB	PCB-44/47/65									5.1	5.0 - 10
2,2',3,6-TetraCB/2,2',4,6'-TetraCB	PCB-45/51									3.5	5.0 - 10
2,2',3,6'-TetraCB	PCB-46									1.5	5.0 - 10
2,2',4,5-TetraCB	PCB-48									2.8	5.0 - 10
2,2',4,5'-TetraCB/2,3',4,6-TetraCB	PCB-49/69									6.4	5.0 - 10
2,2',4,6-TetraCB/2,2',5,6'-TetraCB	PCB-50/53									6.2	5.0 - 10
2,2',5,5'-TetraCB	PCB-52									3.7	5.0 - 10
2,2',6,6'-TetraCB	PCB-54									2.2	5.0 - 10
2,3,3',4'-TetraCB	PCB-55									6.0	5.0 - 10
2,3,3',4'-TetraCB	PCB-56									5.1	5.0 - 10
2,3,3',5-TetraCB	PCB-57									4.0	5.0 - 10
2,3,3',5'-TetraCB	PCB-58									6.9	5.0 - 10
2,3,3',6-TetraCB/2,3,4,6-TetraCB/2,4,4',6-TetraCB	PCB-59/62/75									7.0	5.0 - 10

Table 3-2b. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Water Samples.

		Ecological Screening Values		Human Health Screening Values			Analytical Concentration Goals			MDLs and MRLs	
Analytes	**Congener number (PCBs only)**	**AWQC [1]**	**ORNL [2]**	**EPA Region 9 Tap water PRG [3]**	**Fish Consumption Only [4]**	**Site-Specific Fish Consumption Only [5]**	**Level 1 ACG [6]**	**Level 2 ACG [7]**	**Level 3 ACG [8]**	**MDL**	**MRL**
2,3,4,4'-TetraCB	PCB-60									4.4	5.0 - 10
2,3,4,5-TetraCB/2,3',4',5-TetraCB/2,4,4',5-TetraCB/2',3,4',5-TetraCB	PCB-61/70/74/76									10.1	5.0 - 10
2,3,4',5-TetraCB	PCB-63									2.4	5.0 - 10
2,3,4', 6-TetraCB	PCB-64									3.3	5.0 - 10
2,3',4,4'-TetraCB	PCB-66									6.5	5.0 - 10
2,3',4,5-TetraCB	PCB-67									5.8	5.0 - 10
2,3',4,5'-TetraCB	PCB-68									4.6	5.0 - 10
2,3',5,5'-TetraCB	PCB-72									4.3	5.0 - 10
2,3',5',6-TetraCB	PCB-73									1.9	5.0 - 10
3,3',4,4'-TetraCB	PCB-77									2.8	5.0 - 10
3,3',4,5-TetraCB	PCB-78									3.2	5.0 - 10
3,3',4,5'-TetraCB	PCB-79									4.2	5.0 - 10
3,3',5,5'-TetraCB	PCB-80									3.7	5.0 - 10
3,4,4',5-TetraCB	PCB-81									3.0	5.0 - 10
2,2',3,3',4-PentaCB	PCB-82									2.2	5.0 - 10
2,2',3,3',5-PentaCB/2,2',4,4',5-PentaCB	PCB-83/99									4.0	5.0 - 10
2,2',3,3',6-PentaCB	PCB-84									1.9	5.0 - 10
2,2',3,4,6-PentaCB/2,2',3,4',6-PentaCB	PCB-88/91									3.8	5.0 - 10
2,2',3,4,6'-PentaCB	PCB-89									1.5	5.0 - 10
2,2',3,5,5'-PentaCB	PCB-92									2.3	5.0 - 10
2,2',3,5,6'-PentaCB	PCB-94									4.0	5.0 - 10
2,2',3,5',6-PentaCB/2,2',3,5,6 -PentaCB/2,2',4,4',6 -PentaCB/2,2',4,5,6'-PentaCB	PCB-95/100/93/102									9.7	5.0 - 10
2,2',3,6,6'-PentaCB	PCB-96									2.0	5.0 - 10
2,2',4,5,6'-PentaCB	PCB-103									3.9	5.0 - 10

Table 3-2b. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Water Samples.

		Ecological Screening Values		Human Health Screening Values			Analytical Concentration Goals			MDLs and MRLs	
Analytes	**Congener number (PCBs only)**	**AWQC [1]**	**ORNL [2]**	**EPA Region 9 Tap water PRG [3]**	**Fish Consumption Only [4]**	**Site-Specific Fish Consumption Only [5]**	**Level 1 ACG [6]**	**Level 2 ACG [7]**	**Level 3 ACG [8]**	**MDL**	**MRL**
2,2',4,6,6'-PentaCB	PCB-104									3.2	5.0 - 10
2,3,3'4,4'-PentaCB	PCB-105									0.9	5.0 - 10
2,3,3'4,5-PentaCB	PCB-106									4.1	5.0 - 10
2,3,3',4',5-PentaCB/2',3,4,5,5'-PentaCB	PCB-107/124									1.9	5.0 - 10
2,3,3',4,5'-PentaCB/2,3',4,4',6-PentaCB/2,2',3,4,5-PentaCB/2,2',3',4,5-PentaCB	PCB-108/119/86/97									8.4	5.0 - 10
2,3,3',4,6-PentaCB	PCB-109									2.9	5.0 - 10
2,3,3',4',6-PentaCB/2,3,4,4',6-PentaCB	PCB-110/115									2.7	5.0 - 10
2,3,3',5,5'-PentaCB	PCB-111									2.0	5.0 - 10
2,3,3',5,6-PentaCB	PCB-112									1.7	5.0 - 10
2,3,3',5',6-PentaCB	PCB-113									5.1	5.0 - 10
2,3,4,4',5-PentaCB	PCB-114									1.6	5.0 - 10
2,3,3',5',6-PentaCB/2,3,4,5,6-PentaCB/2,2',3,4,4'-PentaCB	PCB-117/116/85									7.2	5.0 - 10
2,3',4,4',5-PentaCB	PCB-118									2.4	5.0 - 10
2,3',4,5,5'-PentaCB	PCB-120									2.5	5.0 - 10
2,3',4,5,6-PentaCB	PCB-121									2.1	5.0 - 10
2',3,3',4,5-PentaCB	PCB-122									4.7	5.0 - 10
2',3,4,4',5-PentaCB	PCB-123									3.2	5.0 - 10
3,3',4,4',5-PentaCB	PCB-126									1.5	5.0 - 10
3,3',4,5,5'-PentaCB	PCB-127									3.5	5.0 - 10
2,2',3,3',4,4'-HexaCB/2,3,4,4',5,6-HexaCB	PCB-128/166									3.2	5.0 - 10
2,2',3,3',4,5'-HexaCB	PCB-130									1.3	5.0 - 10
2,2',3,3',4,6-HexaCB	PCB-131									1.9	5.0 - 10
2,2',3,3',4,6'-HexaCB	PCB-132									2.5	5.0 - 10
2,2',3,3',5,5'-HexaCB	PCB-133									2.4	5.0 - 10

Table 3-2b. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Water Samples.

Analytes	Congener number (PCBs only)	Ecological Screening Values		Human Health Screening Values			Analytical Concentration Goals			MDLs and MRLs	
		AWQC [1]	ORNL [2]	EPA Region 9 Tap water PRG [3]	Fish Consumption Only [4]	Site-Specific Fish Consumption Only [5]	Level 1 ACG [6]	Level 2 ACG [7]	Level 3 ACG [8]	MDL	MRL
2,2',3,3',5,6-HexaCB/2,2',3,4,5,6'-HexaCB	PCB-134/143									3.3	5.0 - 10
2,2',3,3',6,6'-HexaCB	PCB-136									2.3	5.0 - 10
2,2',3,4,4',5-HexaCB	PCB-137									2.5	5.0 - 10
2,2',3,4,4',5'-HexaCB/2,3,3',4',5,6-HexaCB/2,2',3,3',4,5 -HexaCB/2,3,3',4,5,6-HexaCB	PCB-138/163/129/160									4.5	5.0 - 10
2,2',3,4,4',6-HexaCB/2,2',3,4,4',6'-HexaCB	PCB-139/140									3.9	5.0 - 10
2,2',3,4,5,5'-HexaCB	PCB-141									1.5	5.0 - 10
2,2',3,4,5,5'-HexaCB	PCB-142									3.9	5.0 - 10
2,2',3,4,5',6-HexaCB	PCB-144									2.0	5.0 - 10
2,2',3,4,6,6'-HexaCB	PCB-145									2.0	5.0 - 10
2,2',3,4',5,5'-HexaCB	PCB-146									1.3	5.0 - 10
2,2',3,4',5,6-HexaCB/2,2',3,4',5',6 -HexaCB	PCB-147/149									2.3	5.0 - 10
2,2',3,4',5,6'-HexaCB	PCB-148									2.7	5.0 - 10
2,2',3,4',6,6'-HexaCB	PCB-150									2.5	5.0 - 10
2,2',3,5,5',6-HexaCB/2,2',3,3',5,6'-HexaCB/2,2',4,4',5',6-HexaCB	CB-151/135/154									6.8	5.0 - 10
2,2',3,5,6,6'-HexaCB	PCB-152									1.5	5.0 - 10
2,2',4,4',5,5'-HexaCB/2,3',4,4',5',6-HexaCB	PCB-153/168									3.8	5.0 - 10
2,2',4,4',6,6'-HexaCB	PCB-155									3.1	5.0 - 10
2,3,3',4,4',5-HexaCB/2,3,3',4,4',5'-HexaCB	PCB-156/157									1.2	5.0 - 10
2,3,3',4,4',6-HexaCB	PCB-158									1.3	5.0 - 10

Table 3-2b. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Water Samples.

		Ecological Screening Values		Human Health Screening Values			Analytical Concentration Goals			MDLs and MRLs	
Analytes	Congener number (PCBs only)	AWQC [1]	ORNL [2]	EPA Region 9 Tap water PRG [3]	Fish Consumption Only [4]	Site-Specific Fish Consumption Only [5]	Level 1 ACG [6]	Level 2 ACG [7]	Level 3 ACG [8]	MDL	MRL
2,3,3',4,5,5'-HexaCB	PCB-159									2.3	5.0 - 10
2,3,3',4,5',6-HexaCB	PCB-161									1.6	5.0 - 10
2,3,3',4',5,5'-HexaCB	PCB-162									2.8	5.0 - 10
2,3,3',4',5',6-HexaCB	PCB-164									1.7	5.0 - 10
2,3,3',5,5',6-HexaCB	PCB-165									3.1	5.0 - 10
2,3,4,4',5,5'-HexaCB	PCB-167									1.5	5.0 - 10
3,3',4,4',5,5'-HexaCB	PCB-169									1.2	5.0 - 10
2,2',3,3',4,4',5-HeptaCB	PCB-170									2.0	5.0 - 10
2,2',3,3',4,4',6-HeptaCB/2,2',3,3',4,5,6-HeptaCB	PCB-171/173									2.1	5.0 - 10
2,2',3,3',4,5,5'-HeptaCB	PCB-172									2.3	5.0 - 10
2,2',3,3',4,5,6'-HeptaCB	PCB-174									2.9	5.0 - 10
2,2',3,3',4,5',6-HeptaCB	PCB-175									1.7	5.0 - 10
2,2',3,3',4,6,6'-HeptaCB	PCB-176									2.7	5.0 - 10
2,2',3,3',4',5,6-HeptaCB	PCB-177									3.4	5.0 - 10
2,2',3,3',5,5',6-HeptaCB	PCB-178									0.8	5.0 - 10
2,2',3,3',5,6,6'-HeptaCB	PCB-179									2.3	5.0 - 10
2,2',3,4,4',5,5'-HeptaCB/2,3,3',4',5,5',6-HeptaCB	PCB-180/193									6.2	5.0 - 10
2,2',3,4,4',5,6-HeptaCB	PCB-181									3.7	5.0 - 10
2,2',3,4,4',5,6'-HeptaCB	PCB-182									2.4	5.0 - 10
2,2',3,4,4',5',6-HeptaCB/2,2',3,4,5,5',6-HeptaCB	PCB-183/185									2.3	5.0 - 10
2,2',3,4,4',6,6'-HeptaCB	PCB-184									2.7	5.0 - 10
2,2',3,4,5,6,6'-HeptaCB	PCB-186									2.3	5.0 - 10
2,2',3,4,5,5',6-HeptaCB	PCB-187									1.9	5.0 - 10
2,2',3,4',5,6,6'-HeptaCB	PCB-188									2.6	5.0 - 10

Table 3-2b. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Water Samples.

		Ecological Screening Values		Human Health Screening Values			Analytical Concentration Goals			MDLs and MRLs	
Analytes	**Congener number (PCBs only)**	**AWQC [1]**	**ORNL [2]**	**EPA Region 9 Tap water PRG [3]**	**Fish Consumption Only [4]**	**Site-Specific Fish Consumption Only [5]**	**Level 1 ACG [6]**	**Level 2 ACG [7]**	**Level 3 ACG [8]**	**MDL**	**MRL**
2,3,3',4,4',5,5'-HeptaCB	PCB-189									2.0	5.0 - 10
2,3,3',4,4',5,6-HeptaCB	PCB-190									3.7	5.0 - 10
2,3,3',4,4',5',6-HeptaCB	PCB-191									2.8	5.0 - 10
2,3,3',4,5,5',6-HeptaCB	PCB-192									3.7	5.0 - 10
2,2',3,3',4,4',5,5'-OctaCB	PCB-194									0.8	5.0 - 10
2,2',3,3',4,4',5,6-OctaCB	PCB-195									2.8	5.0 - 10
2,2',3,3',4,4',5,6'-OctaCB	PCB-196									3.6	5.0 - 10
2,2',3,3',4,4',6,6'-OctaCB/2,2',3,3',4,5,6,6'-OctaCB	PCB-197/200									2.4	5.0 - 10
2,2',3,3',4,5,5',6-OctaCB/2,2',3,3',4,5,5',6'-OctaCB	PCB-198/199									5.1	5.0 - 10
2,2',3,3',4,5',6,6'-OctaCB	PCB-201									2.6	5.0 - 10
2,2',3,3',5,5',6,6'-OctaCB	PCB-202									2.1	5.0 - 10
2,2',3,4,4',5,5',6-OctaCB	PCB-203									2.5	5.0 - 10
2,2',3,4,4',5,6,6'-OctaCB	PCB-204									1.7	5.0 - 10
2,3,3',4,4',5,5',6-OctaCB	PCB-205									2.9	5.0 - 10
2,2',3,3',4,4',5,5',6-NonaCB	PCB-206									3.5	5.0 - 10
2,2',3,3',4,4',5,6,6'-NonaCB	PCB-207									2.2	5.0 - 10
2,2',3,3',4,5,5',6,6'-NonaCB	PCB-208									1.9	5.0 - 10
DecaCB	PCB-209									2.8	5.0 - 10

Notes:

[1] AWQC based on NRWQC freshwater aquatic life criteria (EPA 2002c).

[2] ORNL based on Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota (Suter and Tsao 1996) .

[3] Based on EPA Region 9 Preliminary Remediation Goals (PRGs) (EPA 2002b).

[4] Based on NRWQC human health criteria (EPA 2002c) and The Revised Human Health Water Quality Criteria (EPA 2003).

[5] Based on Portland Harbor site-specific fish consumption rates in HHRA work plan of up to 175 g/day.

Table 3-2b. Analytes, Analytical Concentration Goals, Method Detection Limits, and Method Reporting Limits for Water Samples.

		Ecological Screening Values		Human Health Screening Values			Analytical Concentration Goals			MDLs and MRLs	
Analytes	**Congener number (PCBs only)**	**AWQC [1]**	**ORNL [2]**	**EPA Region 9 Tap water PRG [3]**	**Fish Consumption Only [4]**	**Site-Specific Fish Consumption Only [5]**	**Level 1 ACG [6]**	**Level 2 ACG [7]**	**Level 3 ACG [8]**	**MDL**	**MRL**

[6] Level 1 ACGs are the lowest of the EPA Region 9 PRGs for Tap Water (EPA 2002b), NRWQC freshwater aquatic life criteria (EPA 2002c), or ORNL values (Suter and Tsao 1996).

[7] Level 2 ACGs are the lowest of the EPA Region 9 PRGs for Tap Water (EPA 2002b), NRWQC freshwater aquatic life criteria and human health criteria (EPA 2002c), ORNL values (Suter and Tsao 1996), and the fish consumption criteria from the Revised Human Health Water Quality Criteria (EPA 2003).

[8] Level 3 ACGs are the lowest of the EPA Region 9 PRGs for Tap Water (EPA 2002b), NRWQC freshwater aquatic life criteria and human health criteria (EPA 2002c), ORNL values (Suter and Tsao 1996), the subsistence fish consumption criteria from the Revised Human Health Water Quality Criteria (EPA 2003), and site-specific subsistence fish consumption criteria.

[9] Required for natural attenuation evalutaion (Anchor Environmental 2004).

[10] Parameters for calculating freshwater dissolved metals criteria that are hardness-dependent are from NRWQC (EPA 2002c). Hardness dependent criteria based on average hardness of 25 mg/L ($CaCO_3$) (USGS database from 1974 to 1990).

Table 3-3. Sample Containers and Preservation Requirements for Sediment Trap and Stormwater Samples

Container [1] Type	Container [1] Size	Laboratory	Analysis	Preservation	Holding Time
Sediment Trap Samples					
WMG	8 oz.	Alta	PCB Congeners	Deep Frozen (-20°C)	1 year
WMG	16 oz. [2]	CAS	Total organic carbon	4 ± 2°C	28 days [3]
			Percent solids		6 months [3]
			Metals		6 months [3]
			Mercury		28 days [3]
WMG	16 oz.	CAS	Organochlorine pesticides	4 ± 2°C	1 year
			PAHs and Phthalates		1 year
WMG	8 oz.	CAS	Chlorinated herbicides	4 ± 2°C	1 year
WMG	8 oz.	CAS	Grain size	4 ± 2°C	6 months
Stormwater Samples					
HDPE	1 liter	CAS	Total suspended solids	4 ± 2°C	7 days
HDPE	250 mL	CAS	Total organic carbon	H_2SO_4 to pH < 2; 4 ± 2°C	28 days
HDPE	1 liter	CAS	Total metals	5 mL of 1:1 HNO_3; 4 ± 2°C	6 months/60 days [4]
AG	1 liter	CAS	Organochlorine pesticides	4 ± 2°C	7/40 days [5]
AG	1 liter	CAS	PAHs	4 ± 2°C	7/40 days [5]
AG	1 liter	CAS	Phthalates	4 ± 2°C	7/40 days [5]
AG	1 liter	Alta	PCB Congeners	4 ± 2°C	7/40 days [5]
AG	1 liter	CAS	Chlorinated herbicides	4 ± 2°C	7/40 days [5]

Notes:

AG - amber glass
CAS - Columbia Analytical Services
HDPE - high density polyethylene
WMG - wide mouth glass

[1] The size and number of containers may be modified by the analytical laboratories. Archive samples will be collected for all of the sediment samples.

[2] An additional 8 oz. to 16 oz. jar needed for lab QC for 5% of samples.

[3] Holding times for frozen samples are as follows: Total organic carbon, 1 year; metals (except mercury) and percent solids, 2 years.

[4] The holding time for mercury is 60 days, based on CRITFC study (EPA 2002a) and EPA Method 1631 revision D (EPA 2001a). The holding time for the remaining metals is 6 months.

[5] The holding time is 7 days from collection to extraction, and 40 days from extraction to analysis.

Table 4-1. Laboratory Control Limits for Surrogate Samples

Analyte	Percent Recovery
Sediment Samples	
Chlorinated Herbicides	
2,4-Dichlorophenylacetic acid	22-132
Organochlorine Pesticides	
Tetrachloro-*m*-xylene	19-134
Decachlorobiphenyl	26-144
PCB Aroclors	
Tetrachloro-*m*-xylene	19-134
Decachlorobiphenyl	26-144
PAHs and Phthalate Esters	
2,4,6-Tribromophenol	12-111
2-Fluorobiphenyl	10-109
2-Fluorophenol	10-85
Nitrobenzene-d5	10-100
Phenol-d6	17-96
Terphenyl-d14	21-122
Stormwater Samples	
Chlorinated Herbicides	
2,4-Dichlorophenylacetic acid	10-121
Organochlorine Pesticides	
Tetrachloro-*m*-xylene	18-125
Decachlorobiphenyl	10-145
PAHs and Phthalate Esters	
2,4,6-Tribromophenol	44-124
2-Fluorobiphenyl	49-105
2-Fluorophenol	42-104
Nitrobenzene-d5	51-113
Phenol-d6	49-113
Terphenyl-d14	27-136

Note:
Control limits are updated periodically by the laboratories. Control limits that are in effect at the laboratory at the time of analysis will be used for sample analysis and data validation. These may differ slightly from the control limits shown in this table.

Table 4-2. Laboratory Control Limits for Matrix Spike and Laboratory Control Samples

Analyte	Matrix Spike Recovery (percent)	Laboratory Control Sample Recovery (percent)	Type of Duplicate	Control Limit Relative Percent Difference
Sediment Samples				
Conventional Analyses				
Total solids	NA	NA	LD	20
Grain size	NA	NA	Triplicate	Note-1
Total organic carbon	75-125	85-115	LD	20
Metals				
Aluminum	75-125	Note-2	LD	30
Antimony	20-108	Note-2	LD	30
Arsenic	74-120	Note-2	LD	30
Cadmium	63-136	Note-2	LD	30
Chromium	60-144	Note-2	LD	30
Copper	57-141	Note-2	LD	30
Lead	66-134	Note-2	LD	30
Mercury	60-128	Note-2	LD	30
Nickel	74-127	Note-2	LD	30
Selenium	62-123	Note-2	LD	30
Silver	83-107	Note-2	LD	30
Zinc	50-149	Note-2	LD	30
Chlorinated Herbicides				
2,4,5-T	28-138	41-133	LCSD	40
2,4,5-TP (Silvex)	20-137	40-131	LCSD	40
2,4-D	19-129	41-115	LCSD	40
2,4-DB	10-171	31-147	LCSD	40
Dalapon	10-137	18-112	LCSD	40
Dicamba	17-138	43-124	LCSD	40
Dichlorprop	22-121	38-113	LCSD	40
Dinoseb	10-108	10-112	LCSD	40
MCPA	10-145	31-125	LCSD	40
MCPP	13-129	24-137	LCSD	40
Organochlorine Pesticdes				
2,4'-DDD	14-150	38-149	MSD	40
2,4'-DDE	14-152	39-149	MSD	40
2,4'-DDT	10-149	38-146	MSD	40
4,4'-DDD	15-144	48-145	MSD	40
4,4'-DDE	11-151	47-147	MSD	40
4,4'-DDT	10-163	47-150	MSD	40
Total DDT	NA	NA	NA	NA
Aldrin	11-146	41-137	MSD	40
alpha-BHC	16-140	43-144	MSD	40

Table 4-2. Laboratory Control Limits for Matrix Spike and Laboratory Control Samples

Analyte	Matrix Spike Recovery (percent)	Laboratory Control Sample Recovery (percent)	Type of Duplicate	Control Limit Relative Percent Difference
beta-BHC	18-142	52-139	MSD	40
delta-BHC	18-158	56-154	MSD	40
gamma-BHC (Lindane)	14-147	45-141	MSD	40
alpha-Chlordane	11-149	47-137	MSD	40
gamma-Chlordane	10-146	45-137	MSD	40
Oxychlordane	10-137	42-130	MSD	40
cis -Nonachlor	31-126	47-137	MSD	40
trans -Nonachlor	34-125	50-130	MSD	40
Total Chlordane [a]	NA	NA	NA	NA
Dieldrin	20-139	46-139	MSD	40
Endosulfan I	10-135	32-127	MSD	40
Endosulfan II	10-130	41-129	MSD	40
Endosulfan sulfate	10-152	48-139	MSD	40
Endrin	10-160	50-145	MSD	40
Endrin aldehyde	10-141	44-137	MSD	40
Endrin ketone	10-146	48-145	MSD	40
Heptachlor	12-147	43-138	MSD	40
Heptachlor epoxide	10-147	46-139	MSD	40
Methoxychlor	14-150	45-156	MSD	40
Mirex	23-151	48-142	MSD	40
Toxaphene	10-172	53-128	MSD	40
Hexachlorobenzene	27-111	29-133	MSD	40
Hexachlorobutadiene	70-130	70-130	MSD	40
Hexachloroethane	70-130	70-130	MSD	40
PCB Aroclors				
All target analytes	60-140	70-130	MSD	40
Polycyclic Aromatic Hydrocarbons				
2-Methylnaphthalene	10-106	43-91	MSD	40
Acenaphthene	10-115	47-94	MSD	40
Acenaphthylene	10-140	51-105	MSD	40
Anthracene	10-131	52-102	MSD	40
Benz(a)anthracene	10-142	53-111	MSD	40
Benzo(a)pyrene	10-128	52-110	MSD	40
Benzo(b)fluoranthene	10-145	52-111	MSD	40
Benzo(g,h,i)perylene	10-129	36-126	MSD	40
Benzo(k)fluoranthene	13-127	54-112	MSD	40
Chrysene	10-146	52-108	MSD	40
Dibenz(a,h)anthracene	16-129	45-124	MSD	40
Dibenzofuran	10-115	45-96	MSD	40

Table 4-2. Laboratory Control Limits for Matrix Spike and Laboratory Control Samples

Analyte	Matrix Spike Recovery (percent)	Laboratory Control Sample Recovery (percent)	Type of Duplicate	Control Limit Relative Percent Difference
Fluoranthene	10-156	50-108	MSD	40
Fluorene	10-123	47-100	MSD	40
Indeno(1,2,3-cd)pyrene	10-138	44-123	MSD	40
Naphthalene	10-111	45-89	MSD	40
Phenanthrene	10-155	51-99	MSD	40
Pyrene	10-157	48-107	MSD	40
Phthalate Esters				
Bis(2-ethylhexyl) phthalate	10-138	37-133	MSD	40
Butylbenzyl phthalate	10-128	50-111	MSD	40
Dibutyl phthalate	10-132	52-116	MSD	40
Diethyl phthalate	10-126	48-112	MSD	40
Dimethyl phthalate	21-114	49-102	MSD	40
Di-n-octyl phthalate	10-133	50-119	MSD	40
PCB Congeners				
All 209 congeners	50-150	NA	MSD	NA
Stormwater Samples				
Conventional Analyses				
Total suspended solids	NA	85-115	LCSD	20
Total organic carbon	65-133	90-109	LD	20
Metals				
Aluminum	70-130	85-115	LD	20
Antimony	70-130	85-115	LD	20
Arsenic	70-130	85-115	LD	20
Cadmium	70-130	85-115	LD	20
Chromium	70-130	85-115	LD	20
Copper	70-130	85-115	LD	20
Lead	70-130	85-115	LD	20
Mercury	73-121	82-114	LD	20
Nickel	70-130	85-115	LD	20
Selenium	70-130	85-115	LD	20
Silver	70-130	85-115	LD	20
Zinc	70-130	85-115	LD	20
Chlorinated Herbicides				
2,4,5-T	27-122	24-128	MSD	30
2,4,5-TP (Silvex)	10-166	19-132	MSD	30
2,4-D	10-134	24-112	MSD	30
2,4-DB	10-148	10-127	MSD	30
Dalapon	10-115	11-109	MSD	30
Dicamba	31-107	28-111	MSD	30

Table 4-2. Laboratory Control Limits for Matrix Spike and Laboratory Control Samples

Analyte	Matrix Spike Recovery (percent)	Laboratory Control Sample Recovery (percent)	Type of Duplicate	Control Limit Relative Percent Difference
Dichlorprop	21-109	26-112	MSD	30
Dinoseb	18-91	14-99	MSD	30
MCPA	10-114	13-110	MSD	30
MCPP	10-98	10-115	MSD	30
Organochlorine Pesticdes				
2,4'-DDD	70-130	31-135	MSD	30
2,4'-DDE	70-130	33-133	MSD	30
2,4'-DDT	70-130	33-133	MSD	30
4,4'-DDD	36-132	34-142	MSD	30
4,4'-DDE	40-128	31-143	MSD	30
4,4'-DDT	33-144	32-149	MSD	30
Total DDT	NA	NA	NA	NA
Aldrin	30-114	24-123	MSD	30
alpha-BHC	43-123	40-131	MSD	30
beta-BHC	38-120	38-134	MSD	30
delta-BHC	43-136	41-147	MSD	30
gamma-BHC (Lindane)	43-120	39-130	MSD	30
alpha-Chlordane	38-123	44-123	MSD	30
gamma-Chlordane	39-120	42-121	MSD	30
Oxychlordane	70-130	67-109	MSD	30
cis -Nonachlor	70-130	75-113	MSD	30
trans -Nonachlor	70-130	77-107	MSD	30
Total Chlordane [a]	NA	NA	NA	NA
Dieldrin	41-118	42-125	MSD	30
Endosulfan I	28-112	30-115	MSD	30
Endosulfan II	32-114	35-121	MSD	30
Endosulfan sulfate	47-120	39-129	MSD	30
Endrin	43-129	45-130	MSD	30
Endrin aldehyde	23-124	25-133	MSD	30
Endrin ketone	45-119	47-126	MSD	30
Heptachlor	35-117	35-126	MSD	30
Heptachlor epoxide	43-116	43-124	MSD	30
Methoxychlor	28-151	32-151	MSD	30
Mirex	70-130	73-118	MSD	30
Toxaphene	29-164	51-157	MSD	30
Hexachlorobenzene	30-104	28-118	MSD	30
Hexachlorobutadiene	70-130	70-130	MSD	30
Hexachloroethane	70-130	70-130	MSD	30
Polycyclic Aromatic Hydrocarbons				

Table 4-2. Laboratory Control Limits for Matrix Spike and Laboratory Control Samples

Analyte	Matrix Spike Recovery (percent)	Laboratory Control Sample Recovery (percent)	Type of Duplicate	Control Limit Relative Percent Difference
2-Methylnaphthalene	49-100	50-104	MSD	30
Acenaphthylene	57-116	68-119	MSD	30
Acenapthene	58-105	63-109	MSD	30
Anthracene	43-117	66-112	MSD	30
Benz(a)anthracene	53-118	71-116	MSD	30
Benzo(a)pyrene	44-120	64-116	MSD	30
Benzo(b)fluoranthene	43-134	64-122	MSD	30
Benzo(g,h,i)perylene	45-126	62-127	MSD	30
Benzo(k)fluoranthene	44-132	66-125	MSD	30
Chrysene	53-120	71-112	MSD	30
Dibenz(a,h)anthracene	46-127	65-127	MSD	30
Fluoranthene	50-123	64-118	MSD	30
Fluorene	61-112	66-112	MSD	30
Indeno(1,2,3-cd)pyrene	45-127	61-125	MSD	30
Naphthalene	51-98	54-103	MSD	30
Phenanthrene	59-111	68-109	MSD	30
Pyrene	52-117	66-111	MSD	30
Phthalate Esters				
Bis(2-ethylhexyl) phthalate	48-132	71-119	MSD	30
Butylbenzyl phthalate	59-122	71-114	MSD	30
Diethyl phthalate	65-125	71-123	MSD	30
Dimethyl phthalate	69-116	72-114	MSD	30
Di-n-butyl phthalate	59-123	67-126	MSD	30
Di-n-octyl phthalate	58-130	68-127	MSD	30
PCB Congeners				
All 209 congeners	50-150	NA	MSD	NA

Notes:

Note-1: RPD control limit is not applicable. Laboratory control limit is ±10 percent in the weight of the fraction.

Note-2: Percent recovery control limits are not applicable. Laboratory control limits are established based on the manufacturer's established range of acceptable concentrations.

[a] Total Chlordane will be calculated as the sum of the five components listed above this entry (alpha-Chlordane, gamma-Chlordane, Oxychlordane, *cis* -Nonachlor, *trans* -Nonachlor).

Table 5-1. Number of Samples to be Collected

Sediment Samples

Parameter	Natural Samples	Field Replicates	Field Rinsate Blank for Phthalates	Total Number of Samples
PCB Congeners	31	2	0	33
TOC	31	2	0	33
Percent Solids	31	2	0	33
Organochlorine pesticides	31	2	0	33
PAHs and Phthalates	31	2	2	35
Metals	31	2	0	33
Herbicides	31	2	0	33
Grain size	31	2	0	33

Stormwater Samples

Parameter	Natural Samples	Field Replicates	Field Rinsate Blanks	Total Number of Samples per Event	Total for 3 events
Stormwater Composite Samples					
TSS	31	2	2	35	105
TOC	31	2	2	35	105
Total Metals	31	2	2	35	105
Filtered Metals	31	2	2	35	105
PAHs	31	2	2	35	105
Phthalates*	11	1	1	13	39
PCB Congeners	31	2	2	35	105
Herbicides	31	2	2	35	105
Organochlorine pesticides	3	1	1	5	15
Stormwater Grab Samples [1]					
TSS	20	1	1	22	NA
TOC	20	1	1	22	NA
PAHs	20	1	1	22	NA
Phthalates*	8	1	1	10	NA
PCB Congeners	20	1	1	22	NA
Herbicides	20	1	1	22	NA
Organochlorine pesticides	3	1	1	5	NA

Notes:

[1] These 10 grab samples will be analyzed for total and dissolved constituents to yield 20 samples for the laboratory. Each of these samples will be field filtered prior to analysis. Concentrations from the field filtered aliquots will be reported by the laboratory as dissolved concentrations. Does not yet include T-4 sampling sites (locations need to be confirmed).

*Phthalates are only sampled at potential source and a few selected non-potential source sites. Does not yet include T-4 phthalate sampling sites (locations need to be confirmed).